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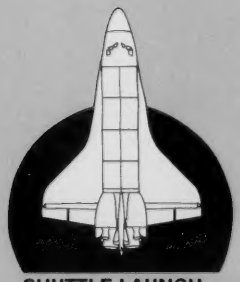

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INTRODUCTION

Scientific and Technical Aerospace Reports (STAR) is a major component of a comprehensive National Aeronautics and Space Administration information system covering aeronautics, space, and supporting disciplines. *STAR* is issued on the 8th and 23rd of each month and announces current publications of the following types:

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By arrangement between NASA and the Smithsonian Science Information Exchange (SSIE), a separate section of information on aerospace-related *On-Going Research Projects* is inserted into each issue of *STAR*. The insert presents titles of active NASA grants and university contracts, summary portions of recently updated *NASA Research and Technology Objectives and Plans (RTOPs)*, and notices of non-NASA research projects that were funded in the most recent or current fiscal year. The latter are selected by SSIE. The project announcements in the insert are arranged by *STAR* divisions but are otherwise entirely separate from *STAR*. They are not indexed nor machine-searchable by NASA. Current and retrospective searches are available from SSIE, 1730 M Street, N.W., Washington, D.C. 20036.

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Subject scope of *STAR*, *IAA*, and *On-Going Research Projects* includes all aspects of aeronautics and space research and development, supporting basic and applied research, and applications. Aerospace aspects of earth resources, energy development, conservation, oceanography, environmental protection, urban transportation, and other topics of high national priority are also covered.

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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

Each major division is further divided into as many as nine specific categories, which are identified by category numbers.

Abstracts in *STAR* are grouped by specific category, the categories appearing in sequential order. Category breaks in the abstract section are identified by the category number and title, and a scope note. Cross-references to other categories are provided as appropriate. For example:

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

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77 THERMODYNAMICS AND STATISTICAL PHYSICS 543
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 543
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 544
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE N.A.
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 545
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 547
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 558
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 559
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 560
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION N.A.
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL N.A.

Note: N.A. means that no abstracts were assigned to this category for this issue.

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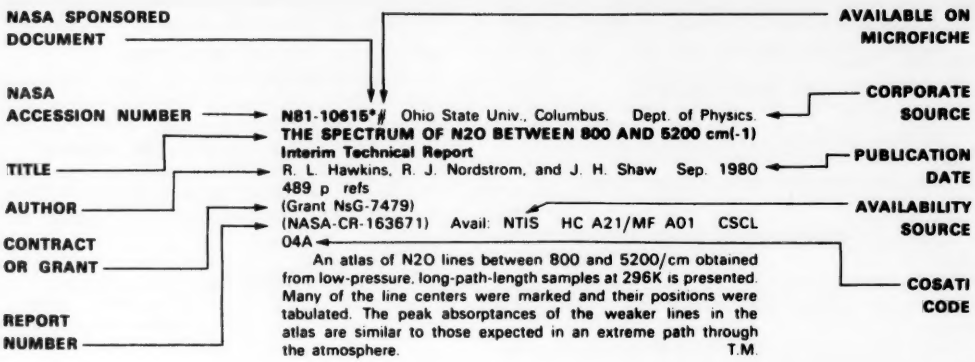
REPORT/ACCESSION NUMBER INDEX I-85

TYPICAL CITATION AND ABSTRACT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N81-10615*# Ohio State Univ., Columbus. Dept. of Physics.
CORPORATE SOURCE
THE SPECTRUM OF N2O BETWEEN 800 AND 5200 cm(-1)
Interim Technical Report
TITLE
R. L. Hawkins, R. J. Nordstrom, and J. H. Shaw Sep. 1980
PUBLICATION DATE
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An atlas of N2O lines between 800 and 5200/cm obtained from low-pressure, long-path-length samples at 296K is presented. Many of the line centers were marked and their positions were tabulated. The peak absorptances of the weaker lines in the atlas are similar to those expected in an extreme path through the atmosphere. T.M.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, EXPERIMENTAL INVESTIGATION OF CONTROL CONCEPTS FOR BUOYANT HYBRID AIRSHIPS USING A SMALL SCALE FLYING MODEL

D.R. Sandlin, California State University & Colleges, California Polytechnic State University, School of Engineering & Technology, Dept. of Aeronautical Engineering, *San Luis Obispo, California* 93407 (NAG 2-61)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0002, RESEARCH STUDY ON C3 FOR NAVAL AIRCRAFT

R.C. Hansen, R.C. Hansen Inc., *Tarzana, California* 91356 (DN890180; N00019-79-M-0401)

Research study of the needs, deficiencies, and technical frontiers in communications, command, and control technology.

This study will survey sources to establish needs, deficiencies, and technical frontiers for communications, command and control in naval aircraft for such functions as weapon control, electronic warfare, reconnaissance and surveillance, communications, etc. The eventual intent is to provide a rationale for research activities that is solidly based on expected operational needs and scenarios.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0003, INTEGRAL FUEL TANK DESIGN HANDBOOK

J.W. Mahoney, Rockwell International Corp., *International Airport, Los Angeles, California* (DF142010; F33615-78-C-3212)

This work unit supports the Air Force's effort to reduce the life cycle costs of future systems. This is to be accomplished through improved design concepts and material selection for integral fuel tanks. The Air Force has experienced severe fuel leak problems from integral type fuel tanks. These problems have been caused partly by poor design practice and environmental degradation of sealant materials. This situation has resulted in a large number of continuing repairs being required for integral fuel tanks. The objective of this effort is to alleviate this problem through the publication of a design handbook which will document approved design details and materials for sealing integral fuel tanks.

It is felt that the basic data and information required to publish a handbook is available within the industry. Thus the first years effort will publish a basic design handbook based on already available data. Future year efforts will update the handbook based on the data to be developed from other parallel programs which will develop improved designs and materials.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0004, INTEGRATED CONTROL SYSTEM ENGINEERING SUPPORT

W.H. Clark, Systems Control Inc., *260 Sheridan Ave., Palo Alto, California* 94306 (DF143670; F33615-79-C-3614)

The Air Force function addressed by this effort is Avionic/Flight Control Integration Concepts for future aerospace vehicles. The problem has been the proliferation of non-standard avionic systems in aircraft with resulting increased life-cycle cost and decreased flexibility. The objective of this effort is to study the effects of applying avionic hardware and standardization concepts to aircraft flight control/crew systems tasks. This work will determine the applicability of these concepts by simulation testing in a flight engineering facility to be developed during the course of this effort.

The Flight Engineering Facility (FEF), which will be developed during the course of this effort, will provide a hot bench facility for evaluation of the hardware and software concepts. The development of the FEF will be an evolutionary process, with experiments being performed as the facility develops.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0005, AERONAUTICAL TECHNOLOGY, TECH AREA I - AERODYNAMICS TECHNOLOGY

I.C. Statler, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Aeromechanics Lab., *Moffett Field, California* 94035 (DA0B5001)

This project provides for technological development in rotary-wing fluid dynamics, acoustics, dynamics, stability, controllability and handling qualities where deficiencies are known to exist in meeting the requirements of future Army airmobile systems. Objectives are to develop handling quality design goals and performance criteria in terms required in future systems and to allow knowledgeable tradeoffs to be made among pilot workload, task performance and costs. This effort will lead to new design criteria and a revised handling qualities MIL SPEC for helicopters. It is intended to contribute not only to the improvement of capabilities in industry, but also to the development of the Army's in-house ability to assess the potential of new systems against predicted requirements.

These objectives will be reached through joint participation with NASA in theoretical and experimental research programs utilizing wind tunnel, ground-based simulation, and flight research capabilities.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Aeromechanics Lab.

1.0006, CRASHWORTHINESS DESIGN PARAMETER SENSITIVITY ANALYSIS

D. Lowry, United Technologies Corp., Sikorsky Division, *N. Main St., Stratford, Connecticut* 06602 (DA0G0420; DAAK51-79-C-0043)

Minimize the adverse impact of crashworthiness design criteria on the cost, weight and performance of future Army helicopter designs and identify R&D efforts required to reduce the cost and weight associated with crashworthiness requirements.

The work to be performed under this procurement shall investigate the effect of MIL-STD-1290, Crashworthiness requirements on future light helicopters. Both metal and composite air-

frame structures shall be investigated. Trend data shall be developed for crashworthiness cost and weight as a function of helicopter weight and as a function of the level of crashworthiness *specified. Crashworthiness cost drivers are to be identified to* assist in determining future R&D efforts necessary to reduce the cost of incorporating crashworthiness into future helicopter designs without reducing the level of crash impact protection from that specified in MIL-STD-1290.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0007, ADVANCED TECHNOLOGY COUPLINGS (MODIFIED MISALIGNMENT COUPLINGS) FOR HELICOPTER TRANSMISSION SYSTEMS

R.A. Stone, United Technologies Corp., Sikorsky Aircraft Division, *N. Main St., Stratford, Connecticut* 06602 (DA0D3940; DAAJ02-74-C-0054)

This program will consist of the investigation of new as well as current helicopter coupling concepts with the overall objective of providing the technology necessary to design couplings characterized by improvements in performance (i.e., misalignment, speed, torque) and weight, very high reliability and good maintainability.

The program is a four task program outlined as follows: Task I -the work to be performed shall consist of an extensive investigation of the capabilities and limitations of current helicopter and industrial couplings, with regard to speed, torque, misalignment, lubrication, reliability and maintainability. Task II - selected coupling candidates will undergo a detail design in conjunction with the formulation of an analytical design technique which will be applicable to any range of speed, torque, misalignment, etc. for the concepts chosen. Tasks III & IV - specific coupling configurations shall be fabricated and tested. All test data will be analyzed to substantiate the analytical design guide, to validate potential performance gains, and identify possible design deficiencies. All design deficiencies will be corrected by redesign with follow-on verification tests.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0008, INVESTIGATION OF FLOW INSTABILITIES ON A ROTATING DISK WITH CURVATURE IN THE RADIAL DIRECTION

M.H. Clarkson, State University System of Florida, University of Florida, School of Engineering, Dept. of Engineering Science & Mechanics, *220 Black Hall, Gainesville, Florida* 32611 (NAG 1-104)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0009, DEVELOPMENT OF A SPINNING WAVE HEAT ENGINE

B.T. Zinn, Georgia Inst. of Technology, School of Aerospace Engineering, *Atlanta, Georgia* 30332 (NAG 3-96)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0010, GROUND EFFECT LANDING GEAR

J.W. Moore, Lockheed Georgia Co., *86 S. Cobb Dr., Marietta, Georgia* 30060 (DF144430; F33615-79-C-3029)

The Air Force airlift mission requires the capability to deploy military units to bases throughout the world. New concepts in distributed load airlift vehicles have a potential problem if required to use existing runways. The landing gear tread width of these designs exceeds the allowable margin. The objective of this effort is an assessment of a ground effect landing gear that would not be restricted by present runway dimensions. A solution to this problem would increase the Air Force global airlift capability.

The approach will involve a three-part evaluation. The first part will analyze the parameters for the ground effect system. The second will determine the airframe/engine matching requirements. The third part will investigate the forward speed effects.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0011, DESIGN STUDY OF TECHNOLOGY REQUIREMENTS FOR HIGH PERFORMANCE SINGLE-PROPELLER-DRIVEN BUSINESS AIRPLANES

D.L. Kohlman, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Aerospace Engineering, *Learned Hall, Lawrence, Kansas* 66044 (NAS 1-16363)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0012, RESEARCH PROGRAM INTO NONCONVENTIONAL CONTROLLERS FOR GENERAL AVIATION AIRPLANES

J. Roskam, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Aerospace Engineering, *Learned Hall, Lawrence, Kansas* 66044 (NAG 1-94)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0013, A PROGRAM TO EVALUATE A CONTROL SYSTEM BASED ON FEEDBACK OF AERODYNAMIC PRESSURE DIFFERENTIALS

R.J. Roskam, University of Kansas, Lawrence Campus, School of Engineering, Dept. of Aerospace Engineering, *Learned Hall, Lawrence, Kansas* 66044 (NAG 4-5)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Hugh L. Dryden Flight Research Center

1.0014, OBSERVER RESPONSE TO HELICOPTER TYPE NOISE BELOW 100 HZ

S. Fidell, Bolt Beranek & Newman Inc., *50 Moulton St., Cambridge, Massachusetts* 02138 (DA0E3840; DAAK51 78 C 0013)

Examine the low frequency helicopter noise region to determine the applicability of the critical bandwidth concept on detectability; investigate infrasonic cueing effects; and incorporate the results in an existing helicopter detection computer program.

Conduct subjective tests in the laboratory using noise masking and noise signal inputs. Primary emphasis will be on frequencies below 100 Hz to determine detectability effects of rotor fundamental frequency and several harmonics. Mathematical modeling will be developed describing the results.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0015, DEVELOPMENT OF ANALYTICAL TECHNIQUES FOR ROTOR AERODYNAMIC ANALYSIS

R.H. Miller, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 2-47)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0016, NAVY VEHICLE DESIGN AND CONSTRUCTION - AIRCRAFT STABILITY AND CONTROL ANALYSIS AT HIGH ANGLES OF ATTACK

R.K. Mehra, Scientific Systems Inc., *1640 Massachusetts Ave., Cambridge, Massachusetts* 02138 (DN675668; N00014-76-C-0780)

At high angles of attack, the flying qualities of most high performance aircraft deteriorate due to undesirable characteristics such as pitch-up, roll coupling, wing rock, and directional divergence. These characteristics significantly reduce tracking capability and maneuverability, and often lead to loss of aircraft control. This program will develop an analytical framework of study for this flight regime, and identify designs of departure preventing control systems. The analysis is based on the Bifurcation and Catastrophe Theory Methodology (BACTM).

Utilizing six degree of freedom equations of motion and a fighter aircraft model equilibrium and bifurcation surfaces will be generated for the stall/spin flight regime. Aircraft flight test data will be used to verify the resultant surfaces as functions of aircraft control parameters. The theory will be applied to spin equations of motion to investigate the cause of post stall divergence, and techniques for spin prevention and recovery will be investigated. Simulation tests will be conducted to validate high angle of attack control techniques and test out the spin prevention and recovery techniques which are developed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0017, DEVELOPMENT OF ADVANCED FLIGHT CONTROL ACTUATION SYSTEM CONCEPTS FOR NAVAL AIRCRAFT

R. Fucht, Bendix Corp., Flight Systems Laboratory, *200 Holister Rd., Teterboro, New Jersey* 07608 (DN981063; N62269-78-C-0247)

The general objective of this task is to examine the broad spectrum of new flight control actuation concepts with respect to potential advantages and interrelationshps with other aircraft systems. The resultant effect of these new concepts will be evaluated against projected aircraft mission and maintenance requirements. Recent advancements in onboard computers, electrical power equipment and solid state processing components may offer advantages to new aircraft, expecially with growing emphasis on combat survivability and simplified squadron maintenance. The specific objective of this effort is to determine how a contractor developed actuation concept can be adapted for aircraft primary flght controls. The unique feature of this concpt is the use of two different power mediums, electricity and bleed air, to drive a single actuator. This contract supports work unit ZA601, Agency Accession No. DN681080.

An actuator will be designed to T 2C aircraft rudder specifications. It will be fabricated, lab tested and flight demonstrated on a T 2C test bed. Ultimate application is aimed at V/STOL aircraft.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0018, ANALYTICAL INVESTIGATION OF INLET INTERNAL FLOW

D.D. Knight, College of Medicine & Dentistry of New Jersey, Rutgers Medical School, School of Medicine, *Box 101, Piscataway, New Jersey* 08854 (DF141280; F33615-78-C-3008)

The objective of this effort is to develop an analytical procedure that can be used to provide a design technique applicable to air induction systems for advanced supersonic/hypersonic military aircraft. Current analytical procedures are limited in their capability to provide the detailed analysis of the inlet internal flow structure that is required for the aerothermodynamic design requirements needed. This program shall be directed towards the development of a procedure that provides the required data. This shall result in a more efficient and rapid design of the air induction system permitting improved vehicle capability.

A numerical procedure shall be employed to calculate the inviscid and viscous flow. Boundary layer bleed flow effects will also be calculated. Data generated under the high speed inlet investigation, F33615-75-C-3072, shall be used for correlation with the theory.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0019, AIRBORNE VELOCITY SENSOR TECHNOLOGY

H.W. Wimmer, General Electric Co., Dept. of Aerospace Electronic Systems, *French Rd., Utica, New York* 13502 (DN781338; N62269-76-C-0306)

The objective of this task is to develop a full function correlation velocity sensor. This work supports work unit ZN101, Agency Accession No. DN081116.

A development model velocity sensor will be built to measure two dimensions of horizontal velocity, including hover, by the correlation technique. The sensor will be designed to operate over all terrains and water surface conditions.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Communication Navigation Tech Directorate

1.0020, EXPERIMENTS ON VISCOUS FLOWS ON SUPERSONIC STREAMS IN XI LEWIS SUPERSONIC WIND TUNNEL

I. Greber, Case Western Reserve University, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *University Cir., Cleveland, Ohio* 44106 (NAG 3-102)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0021, PROPELLER/ROTOR ICING STUDY

K.D. Korkan, Ohio State University, Columbus Campus, School of Engineering, Dept. of Aeronautics & Astronautics, *190 N. Oval Dr., Columbus, Ohio* 43210 (NAG 3-109)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

1.0022, APPLICATION OF FLIGHT LOADS DATA TO THE DEVELOPMENT OF USAGE AND ENVIRONMENTAL SPECTRA

L.E. Clay, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (DF139950; F33615-77-C-3038)

This work unit is being established in order to make available flight loads data which is to be used for design, analysis, and testing of aircraft structures. Recent advances in structural loads data collection methods and equipment have generated large amounts of comprehensive data. There exists at this time no widely accepted method for presenting this data in useful form to aircraft structural designers and analysts. The objective of this effort is to produce a handbook containing significant amounts of data from various types of aircraft, presented so as to be useful to performing analysis and testing as well as to complement structural specifications. Availability of the actual data will lead to more realistic structural test spectra and more representative results.

A handbook containing data and methodology for creating flight-by-flight sequences of loads/stresses will be produced under contract through a multi-source procurement.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0023, LANDING SYSTEM RELIABILITY AND SAFETY MODEL

L.S. Gephart, University of Dayton, School of Business Admin., Dept. of Management Science, *300 College Park Ave., Dayton, Ohio* 45469 (DF134760; F33615-74-C-3075)

No standard for evaluating the reliability and safety of a proposed All Weather Landing System (AWLS) configuration exists within the military or civilian agencies. The objective is to develop a model which can provide a detailed analysis of reliability/safety of the total landing system. All configurations for both primary and back-up operations will be analyzed to enhance the safety of category III weather flight test. The back-up modes will include human capability augmented with back-up hardware configurations. Studies using the model should be able to provide insight on obtaining the highest probability that the aircraft tests will be conducted safely in all weather landings.

The approach will be to develop a reliability/safety model of the C-141/James M. Cox Municipal Airport hardware configurations and the present technical order and FAA advisory circular Operating Procedures for Category III Landings. After model verification, the model will be adapted and modified to other aircraft configurations and other potential operating procedures. Finally, the methodologies of the model will be adapt-

ed and extended to other tests involving landing studies and tests.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0024, DURABILITY METHODS DEVELOPMENT

J.W. Morrow, General Dynamics Corp., *P.O. Box 748, Fort Worth, Texas* 76101 (DF140660; F33615-77-C-3123)

Current Air Force structural integrity policy requires that an Air Force airframe shall be designed such that the economic life is greater than the design service life when subjected to the design service loads/environment spectra. This is necessary to minimize cracking or other structural or material degradation which could result in excessive maintenance or functional problems. Compliance with this policy requires the ability to predict the economic life of an airframe. The objective of this program is to develop and verify the durability methodology necessary to predict the economic life of advanced structures. The results will be used to design more durable military aircraft structures.

Durability methods shall be developed based on a crack growth damage accumulation approach using an equivalent initial quality concept and a statistical approach employing a reliability based model. The most promising of these methods will be evaluated and verified using quantitative structural cracking data obtained from high-time service structures or full-scale test articles. The results will be documented in the form of a durability design handbook.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0025, EXPERIMENTAL DEFINITION OF TOP-MOUNTED INLET FLOW FIELDS

W.W. Rhoades, Vought Corp., Advanced Tech Center Inc, *P.O. Box 5907, Dallas, Texas* 75222 (DF139550; F33615-78-C-3003)

Recent investigations of technology development needs for future air to surface fighters suggest that combat survivability can be enhanced significantly by reducing radar cross section. Top mounted inlets can reduce radar visibility of aircraft. They also facilitate aircraft weight reduction and improved weapon integration. In order to generate top-mounted inlet design criteria, flow fields approaching the inlet must be known. The objective of this program is to generate flow field data typical of top-mounted inlet installations on air to surface aircraft.

Existing wind tunnel model hardware will be modified as necessary and tested from Mach 0.9 to 2.0 in the AEDC PWT 4T facility over a representative set of maneuver attitudes. The model will facilitate testing with variations of leading edge geometry and canopy-fuselage intersection in order to explore a variety of flow fields. A remotely actuated cone probe will be used to define inviscid flow properties on one side of the model while boundary layer rakes gather viscous data on the opposite side. The contractor will provide reduced data to USAF engineers who will analyze the data and present the results in a USAF report.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0026, HT 80-4, APPLICATION OF FINITE ELEMENT METHODOLOGY TO HELICOPTER COMPOSITE PRIMARY STRUCTURES

N.J. Calapodas, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Applied Technology Lab., *Fort Eustis, Newport News, Virginia* 23604 (DA0G2297)

To determine suitability of different NASTRAN elements for application on dynamics of composite structures. Several elements, such as quad, hexa, etc., will be compared with respect to accuracy and computational cost.

The approach to be used is to acquire an existing composite structure (such as OH-58 and/or AH-1G tailboom), model it using various finite element configurations, and perform a parametric study regarding the accuracy of dynamic response as a function of element type and number of elements (computational cost). This work will be preceded by obtaining modal parameters from shake test to serve as comparison data.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Applied Technology Lab.

1.0027, STRUCTURES TECHNOLOGY

J.L. Shipley, U.S. Dept. of Defense, Army, Aviation Research & Development Command, Research & Technology Lab., *Hampton, Virginia* 23665 (DA0E3552)

To investigate helicopter rotor aeroelastic effects, resulting dynamic loading and vibration, maneuvering loads, and to develop analytical techniques for predicting these effects in existing and future Army aircraft. This technology is necessary to preclude the occurrence of these instabilities in flight regimes required of rotorcraft to enhance the safety, survivability, and mission effectiveness. In addition, design criteria will be developed and concepts tested which enhance rotorcraft capability without incurring dynamic limitations.

Research in rotor aeroelasticity analytical efforts will include coupling of the Root Pertubation Method (RPM) computer code with an existing aeroelastic analysis. The strain gage data from the full-scale vacuum chamber tests will be used to evaluate the capability for extracting blade mode shapes. Major emphasis in this tech area will be to implement plans to enhance the capability for predicting helicopter vibrations and the development of techniques for reducing these vibration levels. Control system logic will be designed for the TDT model and closed loop tests of a four-bladed system will be conducted. The program to develop a coupled rotor fuselage structural analysis will be continued. Evaluation of vibration reduction devices will concentrate on completing the state-of-the-art review and the generation of modular math models of vibration reduction devices.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0028, SHUTTLE NOZZLE FLOWFIELD

C.H. Lewis, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Aerospace Engineering, *Blacksburg, Virginia* 24061 (NAG 1-101)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0029, REDUCTION OF INTERNAL NOISE IN MILITARY AIRCRAFT USING STRUCTURAL INTEGRATED SOUNDPROOFING

L.F. Butzel, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF143260; F33615-79-C-3206)

The intense exterior noise associated with military aircraft can cause high noise levels within the aircraft. This structural transmitted noise can degrade flight crew performance, damage electronic equipment and cause structural damage. High interior noise levels can be reduced by incorporating integrated soundproofing into the aircraft fuselage design. Integrated soundproofing is accomplished by tailoring the stiffness, damping and resonances of a structure with the external acoustic field to produce high acoustic transmission losses through the fuselage. The objective of this effort is to investigate techniques of reducing aircraft interior noise levels by using integrated soundproofing to increase fuselage acoustic transmission loss.

The investigation will consist of an analytical study of the acoustic transmission properties of aircraft fuselage structures. This will include the effects of fuselage stiffness, damping and resonances on interior noise with various external acoustic fields. An experimental program will also be conducted. Different structural configurations will be tested for acoustic transmission characteristics. YC-14 data will be used to verify techniques. Criteria for design of fuselage structures with tolerable internal noise levels will result.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0030, NEW REMOTELY PILOTED VEHICLE, RPV, LAUNCH AND RECOVERY CONCEPTS DEVELOPMENT
R.F. Yurczyk, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF137610; F33615-78-C-3404)

The Advanced Remotely Piloted Vehicle (ARPV) has been assigned a definite role in support of combat operations in conventional warfare. A critical link in this role is a capability for high sortie rates and fast turnaround times, which are largely controlled by the effectiveness of the launch recovery system. The objective of this effort is to study several air cushion launch/recovery systems and an air bag skid landing system in terms of system dynamics, operational capability, and cost. This study will allow a valid evaluation of the effectiveness of these systems to be made.

A dynamic model of two basic RPV airframes combined with several different air cushion systems and an air bag skid system shall be made and their dynamic response studied to determine optimum configurations. Preliminary designs incorporating the results of the analysis shall be made. A performance and cost study of the various systems shall be done.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, BASIC RESEARCH IN STRUCTURAL DYNAMICS AND CONTROL OF LARGE FLEXIBLE SPACE STRUCTURES
R.H. Cannon, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NAG 1-97)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

2.0002, PRESENTATION OF SYMPOSIA AND REPORTS IN ADVANCED ELECTRICAL PROPULSION
P.A. McWilliams, University of Pittsburgh, School of Engineering, Dept. of Mechanical Engineering, *402 Engineering Hall, Pittsburgh, Pennsylvania* 15213 (NAS 3-22662)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, STRUCTURE AND PROPERTIES OF GLASSES
J.D. MacKenzie, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Materials Engineering, *405 Hilgard Ave., Los Angeles, California* 90024 (DF039960; AFOSR-79-0019)

AF function - advanced aircraft and tactical missile systems employ glass as a structural and optical component which requires superior mechanical, thermal and optical performance under extreme environmental conditions. Deficiency - the predictive property methodology which is essential for the design of new glass compositions with tailored properties is not well understood. Objective - this research is to establish the fundamental structure-property relationships for optimizing thermal expansion, mechanical strength and hardness, chemical durability, and interactions with infrared and visible radiation in glass. How work contributes - this research is expected to provide concepts and practical compositions for glasses which will meet aircraft windshield and infrared dome performance and laser-resistant materials requirements.

Glass chemistry will center on (1) the understanding of how glass composition and structure control thermal expansion, (2) the mechanism of ion-exchange strengthening of glass under pressure and the effects of surface structure, (3) determination of the effects of structure and chemical composition on optical properties, particularly infrared absorption and reflection in fluoride glasses and glass-ceramics.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0002, WEAPONRY - HYDROCARBON OXIDATION KINETICS FOR USE IN IMPROVING THE DESIGN OF PROPULSION SYSTEMS FOR NAVAL APPLICATIONS
S.S. Penner, University of California, San Diego Campus, Graduate School, Dept. of Chemistry, *P.O. Box 109, La Jolla, California* 92037 (DN475196; N00014-75-C-0261)

The objective of this work is to determine the relative rates of the competitive chain reactions in hydrocarbon oxidation in order to improve the models of hydrocarbon oxidation and nitramine deflagration. This research is relevant to the Navy problem of improving the performance and design of propulsion systems for naval armaments.

In situ gas phase kinetic studies of the nitrous oxide-formaldehyde system will be made in the reflected shock of a pressure driven shock tube. The experiments will determine the concentration time histories of reactants, intermediates and products. Spectroscopic laser techniques will be used to measure concentrations.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0003, LASER STATE SELECTED KINETICS
S.R. Leone, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Chemistry, *1200 University Ave., Boulder, Colorado* 80302 (CHE79-11340)

This research is in the area of Quantum Chemistry. Dr. Leone plans to continue to study the dynamics of chemical kinetics and energy transfer systems using state-selected excitation and detection. Infrared detection capabilities, now highly developed, allow a number of important new areas to be explored. The rates and dynamics of simple bimolecular chemical systems and chain reactions will be further explored. Photofragmentation infrared emission techniques will be used to investigate the spectroscopy, deactivation, and reactions of vibrationally excited free radicals. Electronic excitation transfer in atoms and deactivation of electronically excited atoms upon collisions with reactive atoms will carry his work on electronically excited atoms into new areas of investigation. Vibrationally excited ion-molecule reaction products will be investigated by infrared chemiluminescence techniques in a flowing afterglow. Isotope exchange reactions with vibrationally excited molecules are planned to extend isotonic energy transfer experiments into the reactive domain. An experiment in laser multiphoton ionization of molecules will be started. This research represents a continuation of that currently supported by Foundation grant CHE7622600.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0004, MOLECULAR CHEMISTRY OF INHIBITED COMBUSTION SYSTEMS 13944-CX
J.W. Hastie, U.S. Dept. of Commerce, National Bureau of Standards, *Washington, District of Columbia* 20228 (DA0E9036)

To study flame inhibition mechanisms at a molecular level. Emphasis will be given to the class of inhibitors where bromine is the active component. The research is relevant to work on 'fire-safe fuels.' Fuels with reduced flammability are needed for use in aircraft and armored vehicles. An improved fundamental understanding of the flame inhibition mechanism may lead to the development of a fuel additive to prevent fuel fires and control explosion hazards of fuel storage areas.

The experimental approach will involve the application of state-of-the-art molecular beam high pressure mass spectrometric techniques, together with optical spectroscopy, for the kinetic characterization of inhibited flames. A theoretical descrip-

tion of these flames will be made and compared to experimentally obtained properties.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

3.0005, POLYMER FRACTOGRAPHY - A SCANNING ELECTRON MICROSCOPY ATLAS OF FRACTURES
E.J. Korda, Atlanta University, Graduate School, *223 Chestnut St. S.W., Atlanta, Georgia* 30314 (NAG10-3)

SUPPORTED BY U.S. National Aeronautics & Space Admin., John F. Kennedy Space Center

3.0006, DEVELOPMENT OF BERYLLIUM-TITANIUM COMPOSITE FAN BLADES FOR NAVAL AIRCRAFT ENGINES
M. Herman, General Motors Corp., Detroit Diesel Allison Div, *4700 W. 10th St., Indianapolis, Indiana* 46206 (DN590036; N00019-75-C-0264)

Develop improved beryllium/titanium composite extrusions by optimizing process variables and obtain the design criteria for prototype fan and compressor blades.

Develop and evaluate a process to integrally forge a root attachment on the end of extruding beryllium/titanium composite blade forgings.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0007, EFFECTS OF SURFACE MORPHOLOGY AND CHEMICAL COMPOSITION ON THE DURABILITY OF ADHESIVELY BONDED ALUMINUM STRUCTURES
J.M. Chen, Martin Marietta Corp., *1450 S. Rolling Rd., Baltimore, Maryland* 21227 (DF053000; F49620-78-C-0097)

AF function - the use of adhesively bonded aluminum structures in AF aircraft of all types is continually increasing, not only in quantity, but also in the structural importance of the bonded components. Deficiency - the reliability of adhesively-bonded aluminum structures for aerospace applications is presently limited by their inability to withstand adverse environments. Objective - improve the reliability of adhesively bonded aluminum structures. How work contributes - by obtaining a basic understanding of the relationships between surface properties and environmental durability, significant improvements can be made in bonded aluminum structures.

A systematic study will be performed of the surface properties of aluminum adherends, particularly the physical morphology, chemical composition and crystallographic structure, before and after environmental exposure and with and without bond formation. With a sufficient understanding of the mechanisms involved in adhesion and durability, it will be possible to recommend methods of surface preparation and bond curing procedures to improve long-term durability. Studies of the physical and chemical properties of Al alloy adherend surfaces, will include using advanced techniques of stereo transmission electron microscopy and Auger electron microscopy.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0008, NAVY ENVIRONMENT - STUDIES OF DELAYED FRACTURE MECHANISMS IN ALUMINUM ALLOYS USED IN NAVAL AIRCRAFT AND BOAT STRUCTURES
J.A. Green, Martin Marietta Corp., *1450 S. Rolling Rd., Baltimore, Maryland* 21227 (DN723866; N00014-74-C-0277)

The investigators seek to determine the causes and mechanisms responsible for delayed failure in many strength aluminum alloys used in naval structures when stressed in the marine environment.

The effect of microstructural and compositional variations on a macro- and micro-scale on the delayed fracture behavior of Al-Zn-Mg alloys is being studied. Structure and compositional variations are achieved by heat treatment and characterized by standard metallurgical techniques. Tensile fracture tests are conducted in various environments and fracture characteristics are correlated with structure and composition. A description of the mechanisms of delayed fracture in terms of variations in material, stress and environmental conditions is sought.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0009, INVESTIGATION OF NONDESTRUCTIVE TEST METHODS FOR FIBER REINFORCED METALS (DA0H4713)
Unknown, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center, *Watertown, Massachusetts* 02172 (DA0G0773; TBD)

The technical objective is to investigate, develop, and evaluate non-destructive testing methods applicable to fiber-reinforced metals. Specific applications of these composite materials include helicopter drive systems, in particular transmission cases and reinforcing panels to reduce or suppress vibration and noise. Composite material defects to be detected and measured include fiber-matrix debonding, porosity, fiber misalignment, fiber fracture, non-uniform fiber distribution, and matrix fracture.

The approach for the above objective includes fabrication of fiber-reinforced metal matrix composite specimens with deliberately introduced defects of each type enumerated above.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Materials & Mechanics Research Center

3.0010, A MINIATURE NANOSECOND SPARK DETECTOR FOR LIQUID CHROMATOGRAPHIC ANALYSIS OF CRUDE OILS AND FUELS
S.R. Crouch, Michigan State University, School of Natural Sciences, Dept. of Chemistry, *243 Natural Resources Bldg., East Lansing, Michigan* 48824 (NAG 3-93)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0011, DEVELOPMENT AND APPLICATION OF TRIPLE QUADRUPOLE MASS SPECTROMETRY FOR JET FUEL CHARACTERIZATION
C.G. Enke, Michigan State University, School of Natural Sciences, Dept. of Chemistry, *243 Natural Resources Bldg., East Lansing, Michigan* 48824 (NAG 3-107)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

3.0012, FUNDAMENTAL STUDIES OF BETA PHASE DECOMPOSITION MODES IN TITANIUM ALLOYS
H.I. Aaronson, Michigan Technological University, School of Engineering, Dept. of Metallurgical Engineering, *Houghton, Michigan* 49931 (DF053680; AFOSR-78-3728)

AF function - a rational basis for materials development is required to assure the availability and effective utilization of structural materials in future Air Force systems. Opportunity - the fundamental methodology to provide comprehensive and systematic improvement of existing metallic materials and creation of new materials is dependent upon an understanding of the physical metallurgy of alloys. Objective - this research is to establish the crystallography and mechanism of bainitic compound precipitation in several Ti-x eutectoid systems and to verify and investigate the massive phase transformation mechanisms in titanium alloys. How work contributes - understanding of this phase transformation is necessary in order to furnish a more substantial base for the development of useful titanium alloys in which these processes play an important role in determining their microstructure and mechanical properties at room and moderately elevated temperatures.

Transmission Electron Microscopy (TEM) will be used to determine orientation relationships and microstructural features in bainite reaction studies. In addition, a titanium alloy exhibiting a face-centered-cubic to a hexagonal-close-packed transformation will be studied using a combination of TEM and calori-

metric analyses to determine the unifying properties of nucleation, growth, and phase transformation crystallography.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0013, INCREASING THE DAMPING IN COMPOSITE TRUSS MEMBERS

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SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

3.0014, MATERIALS SUPPORT TECHNOLOGY CHEMICALLY PRODUCED EXCITED STATES

J. Wiesenfeld, Cornell University, Ithaca Campus, School of Arts & Sciences, Dept. of Chemistry, *Ithaca, New York* 14850 (DN323075; N00014-75-C-0828)

The technical objective of this contract is to understand the chemical and physical processes which control the behavior of electronically excited atoms and molecules in the gas phase. The Navy needs more detailed knowledge of chemical reaction kinetics. Particular items here are new techniques for chemical synthesis, rocket propellants with modified plume radiation characteristics, and new materials for chemical lasers.

The lifetime of I(5 doublet p(1/2)) is being determined to try to clarify previous discrepancies. The technique Band Avoidance Continuum Absorption Spectroscopy (BACAS) just developed is being extended to the study of continuum absorptions in other molecules. The quenching of the I(5 doublet p(1/2)) states by CN radicals is being studied.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0015, STARK SPECTROSCOPY OF MOLECULAR SOLIDS

D.M. Manson, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Chemistry, *Stony Brook, New York* 11790 (CHE78-06606)

Effects of external electric fields on electronic spectra of pure and doped molecular crystals, glasses, liquids, and vapors are to be used to locate and characterize charge transfer exciton states in crystals, to characterize the charge distribution in excited vibronic states of molecules, and to probe the microscopic electric field in anisotropic molecular systems. In the experiments, standard methods of high resolution optical spectroscopy are combined with modern techniques of laser excitation and computerized data acquisition and analysis. Supersonic molecular beams may be utilized, and the feasibility of using X-ray diffraction in the presence of an intense optical radiation field to probe the microscopic electric field is to be examined. The experiments will determine the energy of charge transfer exciton states, the validity of the Wannier or Frenkel ion-pair exciton models, the parameters of electron-phonon and exciton-exciton coupling, and the structure of the charge-transfer exciton band, and will document the variation of these properties with chemical composition and crystal structure. The excited vibronic state charge distributions will be characterized by measurements of the dipole moment parameter. The relationship between the macroscopic dielectric properties of molecules in condensed phases and the microscopic characteristics of the molecules is to be derived for various theoretical models, and data are to be obtained to test the validity or applicability of these results to specific real systems.

This research represents a continuation of that currently supported by Foundation Grant CHE-7509680.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0016, PHOTODISSOCIATION OF ATMOSPHERIC POSITIVE IONS

R.C. Dunbar, Case Western Reserve University, Graduate School, Dept. of Chemistry, *2040 Adelbert Rd., Cleveland, Ohio* 44106 (DF249020; F19628-77-C-0157)

AF function - environmental effects of AF operations, nuclear weapons effects, nuclear weapons delivery. Deficiency - the environmental and geophysical effects of AF operations in the atmosphere cannot be accurately predicted. Objective - to measure cross sections for photodissociation and collisional deactivation of atmospheric positive ions using two-photon absorption techniques. How research contributes - provides information required in computer models used to predict environmental and geophysical effects of AF operations in the stratosphere and ionosphere.

Photodissociation cross sections, spectra, and products are measured using an ion cyclotron resonance mass spectrometer to which is coupled a continuous wave tunable dye laser. Collisional deactivation of vibrationally excited ions is studied by varying the mean time between collisions for ions excited by absorption of one photon and subject to dissociation by absorption of a second photon.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

3.0017, INFLUENCE OF COMPOSITION AND MICROSTRUCTURE ON THE LOW-CYCLE FATIGUE RESISTANCE OF A-PHASE AND NEAR A-PHASE ALLOYS

J.C. Williams, Carnegie Mellon University, Carnegie Inst. of Technology, Dept. of Metallurgy & Materials Science, *Frew Ave. & Margaret Morrison, Pittsburgh, Pennsylvania* 15213 (DF042420; AFOSR-76-2925)

AF function - titanium and its alloys have been of considerable interest to the Air Force because of very favorable strength-to-weight characteristics at temperatures from cryogenic up to 800 degrees F, and resistance to attack by many chemicals. Potential applications for skins, structural and engine components of high performance aircraft, cryogenic fuel storage tanks for missiles, and tubing for transporting corrosive fuels all emphasize the available materials roles for titanium alloys. Opportunity - the occurrence of strain localization due to the development of localized regions which are plastically unstable results in severe reductions in fatigue and ductility of many high strength structural materials including certain titanium alloys. Thus, the critical strain for fracture can be locally surpassed at very low average macroscopic strains. Such instabilities can lead to premature failure. Objective - this research will provide an improved understanding of the metallurgical factors which control strain localization, and the relationship of strain localization phenomena to low-cycle fatigue performance of alpha-Ti alloys. How work contributes -the use of alloys which exhibit the tendency for strain localization requires particular caution since the tolerance for local stress concentrations is reduced.

The program consists of two interrelated tasks: (1) the role of alloy composition in controlling deformation behavior and the relationship between deformation behavior and low-cycle fatigue performance, (2) the role of microstructure on deformation behavior and low-cycle fatigue performance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0018, VIBRATIONAL-ROTATIONAL RELAXATION IN CHEMICAL LASERS

F.F. Crim, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Chemistry, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DN975429; N00014-76-C-0341)

Vibrational-rotational relaxation rates in molecular collisions are being determined directly. These are important in the naval areas of lasers and surveillance since they determine, for example, the state population distribution in a molecular laser and how nonequilibrium state distributions relax.

In the initial experiments, a relatively long pluse (microseconds) is used to produce a given excited vibrational-rotational state and a probe laser will measure the population growth in nearby vibrational levels. During this time a short pulse (nanose-

conds) laser system will be set up so that rotational relaxation rates can be measured.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, DEVELOPMENT OF LASER SPECKLE TECHNIQUES AND PROCEDURES FOR DETERMINING STRESSES IN ROTATING TURBINE BLADES

W.F. Swinson, Auburn University, School of Engineering, Dept. of Mechanical Engineering, *Auburn, Alabama* 36830 (NAG 3-103)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0002, ADVANCED RADIAL INFLOW TURBINE INVESTIGATION

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The objective of this project is to define and demonstrate the aerodynamic feasibility of utilizing a single stage, radial inflow turbine in an advanced engine for a potential decrease in size, increased simplicity and reduced cost.

The approach will be the design of a single, advanced design radial inflow turbine stage that will replace multiple, axial stages in a single spool gas generator engine and increase cycle efficiency.

SUPPORTED BY U.S. Dept. of Defense, Tank Automotive Research & Development Command, Propulsion Systems Div.

4.0003, THE STRUCTURE OF TURBULENT VELOCITY FIELDS

F.H. Champagne, University of Arizona, Graduate School, *Tucson, Arizona* 85721 (DF055190; F49620-79-C-0224)

AF function - advanced aerospace vehicles. Opportunity - increased understanding of turbulence and turbulent velocity fields in diffusing and jet augmented flows. Objective - investigate the origin and evolution of puffs in relaminarizing flows and the structure of wakes and jets in co-flowing streams with pressure gradients. How work contributes - a better understanding of the turbulence relaminarization in ducts and the effects of downstream pressure gradient on the persistence of wakes and the mixing of co-flowing streams is directly applicable to many applications of interest to the Air Force in the design of advanced aerospace vehicles, namely, high speed diffusers, jet pumps and augmenters and combustion systems.

An experimental program will be pursued to study the origin and evolution of turbulent puffs in relaminarizing pipe flow. Data on the development of the puffs will be obtained using upstream flush mounted hot wire probes and an array of 10 hot wires panning the radius of the pipe at the exit plane. Investigation of wakes and jets with various downstream pressure gradients will be undertaken in a low turbulence wind tunnel being installed at the University of Arizona.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0004, EPITAXIAL GARNETS AND HEXAGONAL FERRITES

H.L. Glass, Rockwell International Corp., *3370 Miraloma Ave., Anaheim, California* 92803 (DF058060; F49620-80-C-0045)

AF function - microwave electronic components are essential elements of Air Force communications, reconnaissance, surveillance and countermeasures systems. Opportunity - improved performance can be expected from the use of new solid state materials for processing microwave signals. Present microwave solid state signal processing devices which utilize Surface Acoustic Waves (SAW) cannot operate at frequencies greater than a few hundred mHz without encountering difficulties. These difficulties, which include high attenuation and extremely small transducer geometries, are compounded by poor coupling efficiency from electromagnetic to acoustic energy. Objective - the objective of this research is to develop expitaxial layers of Yttrium-Iron-Garnet (YIG) and hexagonal ferrites for utilization in magnetostatic surface wave signal processing devices that operate in the 1 to 25 gHz and 25-60 gHz frequency range, respectively. How work contributes - the research involves the growth and characterization of epitaxial, low-loss temperature compensated YIG films and device quality hexagonal ferrite epitaxial layers. Graded and multiple layer films are also grown for improving device performance.

It examines duct flows, namely (1) the model problem of the curved polar ducts, by studying parametrically the aspect ratio of the cross-section and the longitudinal curvature of the duct will investigate the appearance of Dean's instability - (2) a straight duct of square cross-section will be used for turbulence modeling - and (3) it will investigate the accuracy and efficiency of various numerical solution procedures.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0005, MULTIPHOTON DYNAMICS - ENERGY DISPOSAL DURING DECOMPOSITION OF MOLECULES

P.J. Jorgenson, S R I International, *333 Ravenswood Ave., Menlo Park, California* 94025 (DF052580; F49620-78-C-0107)

AF function - Air Force operations in reconnaissance, communication, surveillance, propulsion, detection and weaponry require knowledge of dynamic chemical processes. Deficiency - details of atomic and molecular interactions in combustion, atmospheric and laser processes are not known. Objective - investigate the detailed dynamics of molecular interactions involving energy disposal, excitation, decomposition, ionization and optical radiation. How work contributes -these experiments will give a better understanding of the energetic processes involved in combustion, atmospheric phenomena and lasers. This understanding will help determine the direction of laser research, atmospheric detection and surveillance technology, combustion devices and effects of Air Force operations in the atmosphere.

A balanced research program of theoretical and experimental techniques will be applied to the problems of multiphoton dynamics leading to intramolecular energy disposition and decomposition, photofragment energy and angular distribution of neutrals and ions, optical and collisional excitation of atoms and molecules and subsequent radiative and non-radiative processes of the excited states, and cross sections for interactions. Experimental techniques include low pressure pyrolysis, laser induced multiphoton absorption, laser-ion coaxial beam photofragment spectrometry, gas discharge, laser induced time resolved fluorescence and chemiluminescence. Theoretical analogs will be developed to elucidate the fundamental processes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0006, CONTRIBUTIONS OF SURFACE CATALYSIS AND GAS PHASE KINETICS TO CATALYTIC COMBUSTOR PERFORMANCE

H. Wise, S R I International, *333 Ravenswood Ave., Menlo Park, California* 94025 (DF049840; F49620-77-C-0123)

AF function - advanced air-breathing engines, airborne weapon delivery, and defense. Deficiency - stable, efficient operating range of catalytic monolith combustors is limited by blow-off at high power, extinction at idle. Objective - assess the relative contributions of surface catalysis and gas phase reaction to catalytic combustor performance under various conditions of preheat, fuel-air ratio, and throughput. How work contributes - results will provide additional understanding and realistic analytical modeling of turbulent reactive flow fields associated with high temperature catalytic combustion not now available, contribute to overcoming present difficulties and assist in optimizing catalyst kinetic properties, catalyst geometry in monolith, and flow parameters for extending the operating range and in improving the stability and efficiency of jet engine catalytic combustors.

Theoretical and experimental studies will be carried out of basic physical and chemical processes of catalytic combustion. The relative contributions of surface catalysis and gas phase reaction in a catalytic combustor will be assessed by developing a detailed computational model for the distributions of velocity, heat and mass (admixed species) in the reactive turbulent flow through a catalytic duct. Measurements will be made of unknown model input parameters. In particular, experimental determinations will be made of the overall global chemical kinetics for catalyzed and gas-phase oxidation of such fuels as propane and JP-4 in air at fuel-lean equivalence ratios over the range of operating temperatures. Verification that the model correctly describes the turbulent transport and its effects on the distribution of reaction will be made in readily observed stagnation point and boundary layer flows over a flat plate, a test section of the plate acting as a sink, instrumented to measure heat transfer to the wall, or as a source, heated externally or by catalyzed reaction for flow probe measurements. The model will then be simplified by identifying local overall kinetic and transport parameters and be applied to identify optimal catalyst location and chemical parameters for stable and efficient duct and monolith combustion.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0007, THE EXPERIMENTAL AND ANALYTICAL DEVELOPMENT OF SENSITIVE SUPERCONDUCTING ACCELEROMETER AND GRAVITY GRADIOMETER

W.M. Fairbank, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (DF041930; AFOSR-76-2913)

AF function - gravity gradiometer is required to determine the deflection of the vertical along flight path to improve the missile CEP. Deficiency - gravity gradiometers are required to operate with an accuracy of ten to the minus 12th power g/m. This is so demanding that closed loop mode operation will be essential. Although present technology of electronic components has reduced the thermal noise levels within the system to their equivalent Brownian motion, cryogenic techniques will be required to make any significant reduction in the respective noise levels. Objective - the properties of the accelerometer and gradiometer to be investigated indicate an exciting potential in applications which are presently difficult and beyond the state of the art of existing techniques. The extremely low threshold suggests measuring the gradient in the gravitational field without excessive averaging times. Contribution - inertial navigators are ultimately limited in accuracy by their knowledge of the local gravity field, in particular the tilt of local vertical. Therefore, improved gravity gradiometer will provide the necessary data to determine the deflection of vertical during the flight path or operation.

It is proposed that instrument design limitations and ultimate threshold sensitivity be investigated and experimentally verified.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0008, LASER INDUCED FLUORESCENCE SPECTROSCOPY FOR MAKING IN-SITU SPECIES CONCENTRATION MEASUREMENTS IN TURBULENT COMBUSTION FLOWS

J.W. Daily, University of California, Berkeley Campus, School of Engineering, Dept. of Mechanical Engineering, *Berkeley, California* 94720 (DF049060; AFOSR-77-3357)

AF function - advanced diagnostic techniques, advanced air-breathing engines, weapon delivery and defense. Deficiency - inability to obtain reliable measurement of important parameters in turbulent reacting flows in practical hostile combustion environment via present day measuring and diagnostic techniques, inability to reliably evaluate combustion models. Objective - to develop sensitive selective, precise, reliable and rapid diagnostic methods for measuring important parameters in jet engine reacting flow environment. To determine feasibility of using Laser Induced Fluorescence Spectroscopy (LIFS) for obtaining high spatial and time resolution in situ species concentration measurements in practical combustion environments, to determine capabilities and limitations of LIFS as a laboratory diagnostic tool, to provide reliable experimental data to the combustion modeler. How work contributes - will provide additional understanding and reliable data to permit realistic evaluation of analytical models of complex reacting flows, will help reduce development time and cost of air-breathing propulsion systems, will permit evaluation of capabilities and limitations of various diagnostic methods, will aid in development of improved or novel new in-situ nondisturbing techniques for accurately measuring turbulent reacting flow parameters.

Using laser induced fluorescence spectroscopy techniques, measurements will be made of hydroxyl radical concentrations in laminar and turbulent laboratory burners. Standard burners will be used wherever possible. Initial work will involve examination of the OH spectrum in both flames, mapping interferences, temperatures and concentrations using conventional absorption and emission spectroscopy. The OH fluorescence spectrum will then be measured in the laminar flame and saturation and trapping effects examined. Results will be used to optimize the excitation and detection schemes. Data acquisition electronics and signal processing will be developed. The system will be applied to the turbulent flame and fluorescence results compared with those from more conventional measuring techniques. The experimental procedures will be guided by and the results compared with a theoretical model that will be developed to describe the excited state populations of OH. Additionally, theoretical predictions of turbulence results will be made using standard theory for comparison with experimental results. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0009, TRANSONIC AERODYNAMICS

J.D. Cole, University of California, Los Angeles Campus, School of Engineering & Applied Science, Dept. of Mechanics & Structures, *405 Hilgard Ave., Los Angeles, California* 90024 (DF055790; F49620-79-C-0162)

AF function - aerospace vehicle design. Opportunity - possibly more economical transonic wing design. Objective - improved analytic techniques for compressible flow problems. How work contributes -numerical parameter optimization is often aided by analytic understanding.

Flow past a finite span wing with Mach number at infinity equal to one has only been addressed to date in a 1953 report from WPAFB by Dr. K.G. Guderley. Guderley's work will be extended to lift and sweepback. A monograph on transonic small disturbance aerodynamics incorporating the many scattered results obtained by Cole and others will be completed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0010, RESEARCH ON WALL TURBULENCE 16651-E

R.F. Blackwelder, University of Southern California, School of Engineering, Dept. of Aerospace Engineering, *3551 University Ave., Los Angeles, California* 90007 (DA0G9124; DAAG29-79-C-0137)

To experimentally determine the unsteady sequence of events associated with the turbulence bursting phenomena in the wall region of an incompressible turbulent boundary layer. Relevance - the research relates to the dynamics of turbulent flows which dominate viscous forces on high speed vehicles such as missiles, projectiles and helicopters.

Special emphasis will be placed upon (1) exploring the effect of the probe size on the statistics measured by different sensors, (2) studying the dynamics of the streamwise vortices in the wall region, and (3) investigating the interaction between the low-speed streaks in the wall region and the high-speed sweeps associated with the outer flow.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0011, INFLUENCE OF GRAVITY INDEPENDENT PARAMETERS ON THE CONSTITUTIVE BEHAVIOR OF SOIL

S. Sture, University of Colorado, Boulder Campus, School of Engineering & Applied Science, Dept. of Civil Environmental & Architectural Engineering, *1200 University Ave., Boulder, Colorado* 80302 (NAG 2-58)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0012, TRANSITION TO TURBULENCE IN SHEAR LAYERS

M.V. Morkovin, Illinois Inst. of Technology, School of Engineering & Physical Science, Dept. of Aerospace & Mechanical Engineering, *3300 S. Federal St., Chicago, Illinois* 60616 (DF046500; F49620-77-C-0013)

AF function - improved aerospace vehicles. Opportunity - increase understanding of the transition to turbulence in shear layer phenomena. Objective - prepare a self-contained comprehensive and reliable guide to the phenomenon of transition to turbulence in shear layers for use by research workers and designers. How work contributes - it will provide an understandable, comprehensive, and reliable guide on transition to turbulence in shear layers for designers to use in future aerospace vehicle designs.

All information presently available in the open literature will be collected, analyzed and organized into a self-contained monograph on transition to turbulence in shear layers. The text will identify what is considered solid, established information, what are tentative concepts based on limited evidence, and what are conjectures and speculations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0013, TRANSIENT BEHAVIOR OF RADIATION AND SCATTERING FROM CONDUCTING BODIES

P.L. Uslenghi, University of Illinois, Chicago Circle Campus, School of Engineering, Dept. of Information Science, *Box 4348, Chicago, Illinois* 60680 (DF047600; AFOSR-77-3253)

AF function - wide band radar detection and EMP hardening of aerospace vehicles. Deficiency - algorithms for electromagnetic radiation and scattering under transient conditions need improvement. Objective - solutions will be sought to five problems in areas of uncertainty. How work contributes - solutions will enhance engineering understanding and thus aid design. Hopefully new design techniques may be suggested.

Solutions to the following problems in transient electromagnetic radiation and scattering will be sought and properties of interest in physical and engineering applications will be investigated. The five problems with the best understood first are transient radiation from spheroidal antennas, constraints on the singularity expansion method for early time transients, loop antennas in a dispersive environment, radiation from truncated guiding structures, and pulsed antenna array radiation pattern design techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0014, MODULATION DOPED GaAs/AlGaAs LAYERED STRUCTURES

M. Morkoc, University of Illinois, Urbana Champaign Campus, Graduate School, *Urbana, Illinois* 61801 (DF057460; AFOSR-80-0084)

Low temperature FET operation has been limited to cooling GaAs FETs which have been designed for room temperature operation in an attempt to achieve better performance. The results have been only slight improvements in noise figure and gain because lowering the temperature of a FET designed for room temperature operation only substantially reduces phenon scattering. The impurity scattering remains and becomes dominant as the temperature is lowered. In order to take full advantage of the lower temperatures, the doping levels must also be reduced while special precautions are taken so that conditions of velocity saturation are maintained. Objective - design and investigate micron and submicron GaAs devices specifically designed for cryogenically cooled applications microwave FETs and high speed topic modulation doped GaAs/AlGaAs layered structures.

Develop the appropriate molecular beam epitaxy-growth procedures, investigate conventional GaAs FETs with and without GaAs and AlGaAs buffer layers, obtain detailed electrical and optical characterization of MBE layers - ion implant source and drain - and determine temperature dependence of electron mobility for the epitaxial layer grown by MBE.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0015, DYNAMIC RESPONSE OF VERTEBRAL ELEMENTS RELATED TO USAF INJURY

J.E. Lafferty, University of Kentucky, School of Engineering, Dept. of Mechanical Engineering, *Limestone & Euclid, Lexington, Kentucky* 40506 (DF046790; AFOSR-78-3488)

AF function - effective ejection of aircrew members from high performance aircraft requires the maximum acceleration allowable within tolerance. The use of biodynamic models has gained widespread acceptance as a means of evaluating human tolerance limits and the probability of injury in environments of severe mechanical stress. Recent evaluation of biodynamic modeling suggests that there is a critical need for experimental data for spinal deformations other than longitudinal. Deficiency - past observations indicate that most of the irreversible damage sustained during ejection is related to the vertebral column. Knowledge of the dynamic material properties of the spinal elements is limited. Objective - this research will determine the load distribution and stress-strain characteristics of the vertebral joints at normal and at right angles to the spinal axis. How research contributes - the tests proposed are unique and will integrate with the AMRL program dealing with vertebral unit strength and interspecies scaling relationships. Results will provide previously unavailable data on spinal column strength. This research is identified in subarea 1.8 'Aircrew safety and effectiveness in mechanical force environments.'

Stress-strain characteristics will be determined as a function of strain-rate for shear, bending, torsion and tension.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0016, SELECTED PROBLEMS IN SYSTEMS ENGINEERING

W.A. Porter, Louisiana State University, Agricultural & Mechanical College, Graduate School, *University Station, Baton Rouge, Louisiana* 70803 (DF050290; AFOSR-78-3500)

AF function - to analyze, design and synthesize electronics systems and aerospace vehicles. Deficiency - complex system engineering problems are continually encountered as a result of using system level approach to obtain maximum mission effectiveness in Air Force aerospace vehicles and support equipment, and as a result of integrating subsystem technology advances. Due to the complexity of the systems and of the appropriate theory available today, the problems are extremely difficult to solve. Objective - to improve the capability to handle these problems by providing a new and more powerful framework for engineering analysis and design. How work contributes - advances in the general theory of nonlinear operators will permit the design and construction of more powerful and cost-effective systems.

Research will continue into the diverse types of causality exhibited by models, into the class of systems represented by polynomic operators, and into the problem of approximating arbitrary causal systems by operators of a simpler type, such as polynomic.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0017, ULTRASONIC AND ACOUSTIC EMISSION DETECTION OF FATIGUE DAMAGE

R.E. Green, Johns Hopkins University, School of Engineering, Dept. of Mechanics, *34th & Charles Sts., Baltimore, Maryland* 21218 (DF043500; F44620-76-C-0081)

AF function - Air Force advanced aerospace vehicles require increased design emphasis on durability and inspectability. New techniques for Nondestructive Evaluation (NDE) are needed to reduce operation and maintenance costs. Deficiency - cost factor estimates for advanced Air Force systems are quite expensive and, as such, not desirable. New inspection techniques coupled with fracture mechanics analysis methods are needed to effectively reduce Air Force serviceability costs. Objective - the object of this research is to extend the state of knowledge involving ultrasonic attenuation and acoustic emission applications and their attendant correlations with hardware used in typical Air Force flight systems. How work contributes - this research contributes to the Air Force program seeking to enhance the reliability and durability of aerospace structures.

Techniques of ultrasonic attenuation and acoustic emission will be used in this research. Experimental techniques and monitoring systems will be investigated to correlate defect initiation and growth characteristics. At a later date studies will evaluate the differences that exist between laboratory specimens and actual aircraft components.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0018, PACKET SPEECH

B. Gold, Massachusetts Inst. of Technology, Lincoln Lab., *244 Wood St., Lexington, Massachusetts* 02173 (DF306616; F19628-78-C-0002)

The objective of this program is to develop and demonstrate techniques for efficient digital speech communication on networks suitable for both voice and data, leading eventually to better interaction between people and computers. This work is carried out in conjunction with other ARPA contractors in the Network Speech Compression (NSC) group sponsored by the Information Processing Technology Office of ARPA.

Starting in FY79, the packet speech and wideband integrated voice/data technology programs will be merged under the title Packet Speech Systems Technology. The merger reflects the strong coupling between voice algorithm and terminal designs,and communications networks requirements. During FY79 efforts will be directed toward the refinement of the spectral envelope estimation algorithm developed in FY78, and toward the continued development of variable rate algorithms that satisfy requirements for adaptive voice flow control in advanced integrated packet switching systems. In addition, attention will be directed at voice terminal designs, with the goal of specifying a complete packet speech terminal for use in the wideband network and other packet switching systems. Work on satellite voice conferencing, internetted voice conferencing, and the development of LSI speech processor hardware will continue, leading toward operational capabilities and systems experiments in the wideband network.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Electronic Systems Div.

4.0019, PHOTOVOLTAIC EFFECT IN FERROELECTRIC CERAMICS

D.J. Epstein, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering & Computer Science, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 1-98)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0020, SPECTRAL METHODS FOR COMPRESSIBLE FLOW PROBLEMS

S.A. Orszag, Massachusetts Inst. of Technology, School of Science, Dept. of Mathematics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF049510; AFOSR-77-3405)

AF function - the design of chemical laser devices, the design of jet engine and engine nacelles for future aircraft. Deficiency - these design problems are hampered by the lack of effective and efficient computational techniques to solve shock wave-boundary layer interaction problems. Objective - this effort will investigate the utility of the spectral methods in solving several classes of compressible flow problems and the application of results to the problem of shock wave-boundary layer interaction. How work contributes - techniques may be developed which are useful in solving problems in lasers and aircraft design.

This research involves the study of the properties of spectral methods for the numerical solution of systems of non-linear hyperbolic equations with nonperiodic boundary conditions. A special case to be considered is the system of inviscid compressible Navier-Stokes equations. Questions of stability and convergence arising in connection with polynomial spectral methods will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0021, INTERCALATED CARBON FIBER CONDUCTOR FOR AEROSPACE USE

J.A. Woolam, University of Nebraska, Lincoln Campus, School of Engineering & Technology, Dept. of Electrical Engineering, *Lincoln, Nebraska* 68508 (NAG 3-95)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0022, AN EXPERIMENTAL AND ANALYTICAL STUDY OF HELICOPTER AERODYNAMICS IN GROUND EFFECT 16061-E

H.C. Curtiss, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Sciences, *Box 430, Princeton, New Jersey* 08540 (DA0F9283; DAAG29-78-G-0194)

To investigate the aerodynamics of rotors in ground effect with particular emphasis on the influence of ground proximity on stability and control of helicopters. Relevance - the research is directly relevant to improving the stability and control of Army helicopters operating in the nap-of-the-earth environment.

An isolated helicopter rotor moving over a fixed ground plane in the Princeton Dynamic Model Track Facility will be employed for the experimental investigations. Experimental measurements will include forces and moments acting on an isolated rotor in and out of ground effect, and surveys of the average air flow velocities in the rotor wake. Results will be analyzed and correlated with theory.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0023, THE INFLUENCE OF CONTACT AND INTERFACE EFFECTS ON THE ELECTRONIC PROPERTIES AND STABILITY OF CHEMICALLY UNSTABLE (AZIDE) MATERIALS 1337

P. Mark, Princeton University, School of Engineering & Applied Sciences, Dept. of Electrical Engineering, *Box 430, Princeton, New Jersey* 08540 (DA0R5578; DAAG29 76 G0017)

To investigate the influence of contact and interface effects in the electric field-assisted initiation of chemically unstable materials. This program will provide fundamental information on the effect of contacts and interface effects on the electronic properties of azides. Understanding of interface dominated effects is crucial to the development of models for field-assisted initiation of explosives.

Various modern aspects of Schottky Barrier Theory and experimentation will be applied to the study of field-assisted initiation. These will include experimental studies of azide surface treatment and metal work function on the initiation and theoretical studies of the applicability of the surface state and chemical bonding models on the behavior of practical Schottky barriers and their relevance to field-assisted initiation.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0024, FUNDAMENTAL STUDIES OF M-S AND MIS SOLAR CELLS ON POLYCRYSTALLINE SILICON

E.S. Yang, Columbia University, School of Engineering & Applied Science, Dept. of Electrical Engineering, *Broadway & W. 116th St., New York, New York* 10027 (AC03-ET23049)

The main purpose of the program is to investigate the fundamental physical processes in polycrystalline-silicon thin-film solar cells. Particular emphasis is placed on the studies of carrier transport and recombination in grain boundaries and their influence on the short-circuit current, open-circuit voltage and fill factor. Detailed knowledge of the basic mechanisms is of primary importance in understanding the limitations of these low cost photovoltaic devices and in pointing out the promising research directions for improving device conversion efficiency.

SUPPORTED BY U.S. Dept. of Energy, Solar Energy Research Inst.

4.0025, ANALYSIS OF WIND ENERGY SYSTEMS

R.J. Thomas, Cornell University, Ithaca Campus, School of Engineering, Dept. of Electrical Engineering, *242 Carpenter Hall, Ithaca, New York* 14853 (NAG 3-104)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0026, SYSTEM COMPACTION AND INTEGRATION-LASERS

C. Yu, University of North Carolina, North Carolina Agricultural & Technical State University, School of Engineering, Dept. of Electrical Engineering, *N. Dudley St., Greensboro, North Carolina* 27411 (NAG 1-82)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

4.0027, EFFECTS OF OXYGEN AND WATER VAPOR ON THE COMPRESSIVE FILM STRENGTH OF BOUNDARY FILMS ON IRON CRYSTALS

D. Snediker, Battelle Memorial Inst., *505 King Ave., Columbus, Ohio* 43201 (DF044220; AFOSR-76-3051)

AF function - propulsion systems for advanced aerospace vehicles require improved lubricants which will withstand a wider range of temperature conditions, greater contact loads and higher shear rates. Deficiency - available lubricants continue to fail due to the detrimental effects of water vapor and oxidation. Objective -investigate the effects of atmospheric oxygen and water on boundary film formation. How work contributes - the information gained from this research will be used to formulate improved lubricants for critical AF applications.

Chemical kinetic methodology will be applied to the study of the film forming process and the behavior of the films will be determined, as manifested by the compressive strengths, with respect to time, temperature, oxygen and water vapor. It is proposed to 1) determine the effects of O2 and H2O on the strength of E-105/TCP boundary films on substrates consisting of evaporated Fe on float glass, 2) perform ESCA studies of the effects of O2 in E-105/TCP films, 3) determine the chemical nature of E-105/TCP films by FTIR spectroscopy, 4) study the effects of substrate composition.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0028, MASS AND HEAT TRANSFER CHARACTERISTICS OF FELT METALS

A. Dybbs, Case Western Reserve University, School of Engineering, Dept. of Mechanical & Aerospace Engineering, *University Cir., Cleveland, Ohio* 44106 (NAG 3-97)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0029, HIGH PHASE ORDER INDUCTION MOTORS

E.A. Klingshirn, Cleveland State University, School of Engineering, Dept. of Electrical Engineering, *1983 E. 24th, Cleveland, Ohio* 44115 (NAG 3-108)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0030, FLUID DYNAMICS OF MULTIPLE NOZZLE ARRAYS AND RADIAL FLOW DIFFUSERS

J.D. Lee, Ohio State University, Columbus Campus, School of Engineering, Dept. of Aeronautical Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (DF042820; AFOSR-76-2956)

AF function - weaponry and aerospace vehicles. Opportunity -improvement in understanding of two aspects of fluid mechanics of gas lasers. These are the diffuser-ejector region, and the turbulent mixing of supersonic streams of reactants. Objective - to gain more basic understanding of the details of mixing between coplanar supersonic streams of dissimilar gases, and to gain a more basic understanding of the flow field in a short, multi-channel diffuser with mixing from local multiple ejectors. How work contributes - this program will provide information useful in the design of high power gas flow lasers.

Coplanar and cylindrical multi-channel supersonic nozzle arrays will be used to supply simulated lasers cavities, both cold and heated, which will be processed through diffuser systems with and without local ejector nozzles. The latter will be used both for boost-pumping and for local boundary layer control. An arc heated wind tunnel fitted with two coplanar supersonic nozzles with separately controlled supply plenums will be used for the mixing study. Temperature turbulence in the mixing region will be monitored on a time-resolved basis by means of electron beam spectroscopy. Sources of turbulence in the flow field will be identified and their importance defined. Methods for measuring the time resolved vibrational temperature of the gas will be investigated. Theoretical modeling of two-stream mixing flow and of ejector pumping flow will be extended.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0031, FINITE STATE MODELS OF MANNED SYSTEMS - VALIDATION, SIMPLIFICATION, AND EXTENSION

R.A. Miller, Ohio State University, Columbus Campus, School of Engineering, Dept. of Industrial & Systems Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (DF054000; AFOSR-79-0015)

AF function - Air Force operations involve a multitude of control related information processing and decision-making tasks which are performed by aircrew personnel. Deficiency - this research will increase the stock of tools available to the analyst for representing and analyzing the discrete control performance of networks of human operators. It may also point the way toward much more fundamental models suitable for the prediction of inference, decision and communication performance of manned systems. Objective - the main objectives of the study are to simplify the process of discrete control model construction and to clarify the theoretical basis, both mathematical and psychological, of discrete control modelling. Existing discrete control data bases will be used for this study. How research contributes-this research is a unique attempt to analyze discrete control decisions of the human operator in a weapon systems context. It is a direct step toward improved ability to predict manned system performance.

The proposed research will involve 1) an assessment of the robustness of previously developed discrete control models, 2) design and implementation of computer-aided procedures for the construction and identification of discrete control models of manned systems, and 3) some preliminary theoretical work on the feasibility of constructing heterarchical information processing systems to represent discrete control tasks, particularly networks consisting of manned systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0032, ROTOR FLOW FIELD RESEARCH IN LOW SPEED HELICOPTER FLIGHT 14142-EX

H.R. Velkoff, Ohio State University, Columbus Campus, School of Engineering, Dept. of Mechanical Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (DA0E9182; DAAG29-79-C-0074)

To experimentally examine and define representative flows past rotors and rotors-fuselage-empennage configurations which model a helicopter in a transitional flight regime. This research investigation is highly relevant to ongoing research at AMRDL in rotor aerodynamic environments characteristic of NOE operations and hence will impact the technological requirements of improved airfoil design, performance, dynamics and handling qualities.

Model rotors, fuselages, and empennages will be designed, fabricated and put in a small wind tunnel and tests will be performed which consist of measurement of velocity distributions in the wake as well as flow visualization to define the characteristics of the flow peculiar to rotors in low advance ratio flight regimes.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0033, APPLICATION OF COHERENT ANTISTOKES RAMAN SCATTERING TO LASER AND COMBUSTION MEDIA

B.R. Won, Systems Research Lab. Inc., *500 Woods Dr., Dayton, Ohio* 45432 (DF461250; F33615-77-C-2019)

Use Coherent Anti-Stokes Raman Scattering (CARS) for measuring species concentrations and temperature as a function of position inside a jet engine combustor.

Use the CARS system already demonstrated to obtain spectra for organic compounds found in fuels and combustion products, use CARS to determine species concentrations vs position within a combustion system.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0034, ENGINEERING AND ANALYSIS SUPPORT OF SIMULATION STUDIES

W. Hovey, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (DF324860; F33615-78-D-0629)

To perform in-depth analyses on data collected in Remotely Piloted Vehicle (RPV) studies and in GBU-15 studies in order to provide data for future simulation studies and systems design.

The raw collected data will be reduced and computations on them will be performed to produce a set of performance measures. These will be used in response surface methodology computations to produce generalized prediction equations, analyses of variance, etc., to study the effects of independent variables on systems performance.

SUPPORTED BY U.S. Dept. of Defense, Aerospace Medical Research Lab., Human Engineering Div.

4.0035, MULTI-IMAGE AUTOMATED INTERPRETATION TECHNIQUES (DAU8041)

Unknown, General Electric Co., *3198 Chestnut St., Philadelphia, Pennsylvania* 19101 (DA0G2484; TO BE DETERMINED)

To develop, test, and evaluate digital and analog automated image processing techniques, routines, and algorithms for extracting terrain information or features for topographic maps, and MGI using panchromatic, multispectral (LANDSAT), radar, and infrared remote sensor imagery or computer compatible tapes as input. Digital/analog image factor map complexing and camouflage detection are secondary objectives.

Identify digital image processing and pattern recognition software to be developed under contract. Develop extraction techniques using LANDSAT, panchromatic, radar, and infrared inputs separately and together for automated extraction of terrain data.

SUPPORTED BY U.S. Dept. of Defense, Corps of Engineers, Data Processing & Products Div.

4.0036, THE UTILIZATION OF ALTERNATE FUELS IN DIESEL ENGINES

S.S. Lestz, Pennsylvania State University, University Park Campus, School of Engineering, Dept. of Mechanical Engineering, *101 Hammond Bldg., University Park, Pennsylvania* 16802 (NAG 3-91)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

4.0037, A NUMERICAL ALGORITHM FOR NONLINEAR FEEDBACK AND NONLINEAR CASCADE COMPENSATION

R.L. Carroll, University of South Carolina, School of Engineering, Dept. of Engineering, *Admin. Bldg., Room 115, Columbia, South Carolina* 29208 (DF054460; AFOSR-79-0001)

AF function - design missile control systems. Deficiency - the performance of an air-to-air missile in a simple-missile-target encounter is degraded with the lack of thrust magnitude control. Objective - the objective of this proposal is to design a novel algorithm which will produce the system control in the form of both a nonlinear state feedback plus a nonlinear cascade compensator. How work contributes - results in this study will aid in the design of thrust controllable missile systems.

An algorithm will be developed which is capable of generating both a nonlinear feedback control and a nonlinear open-loop control. The algorithm will be tested using a nonlinear model for the target-seeking problem. A comparison of the nonlinear controller for the target-seeking model will be made with a controller designed by linear-quadratic means.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0038, NEW NONLINEAR OPTICAL PROCESSES IN MOLECULES AT INFRARED FREQUENCIES

M.F. Becker, University of Texas, Austin Campus, School of Engineering, Dept. of Electrical Engineering, *200 W. 21st, Austin, Texas* 78712 (DF053350; AFOSR-78-3712)

AF function - various nonlinear optical techniques are promising to meet needs for coherent light sources. This research program represents a study of two relatively new types of optical nonlinearity which appear in molecules at infrared frequencies. The first nonlinearity may be characterized as 'hybrid,' in that its nonlinear susceptibility is governed by a near resonant vibrational energy level and off resonant electronic energy levels. The second type of nonlinearity is purely 'vibrational' and its susceptibility is determined solely by combinations of resonant and near resonant vibrational-rotational energy levels. Opportunity - properties of nonlinearities will be studied through third harmonic generations. This effort should help eliminate some of the discrepancies between theory and experiment on nonlinearity of gases. Objective - this work will involve a study of the properties of nonlinear gases through third harmonic generation. A theoretical effort will be undertaken to improve the theoretical experimental agreement on predicted conversion efficiences. Contribution - the most important problem in the technological application of nonlinear optics is the improvement of optical frequency conversion. The investigations of this grant offers potential contributions to this improvement.

This research program represents a study of two relatively new types of optical nonlinearity which appear in molecules at infrared frequencies. The experiments proposed herein are motivated by previous study of third harmonic generation in SF6 and 10.6 microns. The nonlinear susceptibiity for these two new nonlinearities is determined primarily by one or more nearly resonant vibrational energy levels. These resonantly enhanced nonlinearities will provide third hamonic generation and four photon sum and difference frequency generation in the infrared. The properties of these nonlinearities will be studied through third harmonic generation experiments. An experimentally correct, predictive model for the interaction will be developed to understand the nature of the limiting processes which may affect conversion efficiencies at higher power densities.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0039, TITANIUM MATRIX/CONTINUOUS FIBER COMPOSITE INTERFACE INTERACTIONS AND THEIR INFLUENCE ON MECHANICAL PROPERTIES

H.L. Marcus, University of Texas, Austin Campus, School of Engineering, Dept. of Mechanical Engineering, *200 W. 21st, Austin, Texas* 78712 (DF056970; AFOSR-80-0052)

AF function - airframe, aeropropulsion, missile and satellite components could benefit considerably from the use of Metal Matrix Composites (MMC). Opportunity - titanium-matrix composites, for example, in conjunction with innovative fabrication/consolidation methods and fibers such as silicon carbide (SiC), could have a considerable payoff for aircraft and missiles in terms of improved performance and reduced cost. Objective - this research will develop a comprehensive fundamental understanding of how modification of the interface between the titanium alloy matrix and the continuous fibers influences the environmental effects during fatigue crack growth. How work contributes - efforts in the area of selective reinforcement of titanium are effectively an extension of the existing superplastic forming/diffusion bonding technology that the Air Force has emphasized over the past few years.

Detailed investigation of the nature of the interface will be performed as a function of MMC systems and their prior thermal-mechanical processing, and these results will be used to determine the mechanisms of failure. Typical failure modes include debonding, filament splitting, interface failure and matrix failure. Use of optical metallography, scanning Auger electronopy, ann spectroscopy, and scanning electron microscopy will be emphasized. The range of matrix materials to be studied will include an all-alpha Ti alloy, and alpha plus beta Ti alloy, and an all-beta Ti alloy. The fibers will include the SiC on graphite, B4C and borsic fibers.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0040, POWER SYSTEM CONTROL STUDY

J. Perkins, Vought Corp., *P.O. Box 5907, Dallas, Texas* 75222 (DF462270; F33615-78-C-2018)

The purpose of this program is to define, design, and analyze an advanced, integrated aircraft electrical generation and control aircraft electrical generation and control system which will provide the high quality, reliable, no gap power required by next generation Air Force weapon systems. A primary objective of the system design and study, therefore, encompasses the development and application of state of the art technology for yielding a cost-effective electrical generation-control system which will not sustain first and second order faults or failures that result in complete loss of power.

In this study advanced system concepts will be examined. Such concepts include use of (1) solid state switching in areas of power generation and control, bus and load switching and signal sensing, (2) samarium cobalt permanent magnet VSCF generator/starter implementation, (3) smart terminal (microprocessor controllers) applications in areas of the generator control unit, universal multiplex terminal, and integrated load management center designs, (4) dynamic load management and generator control via the EMUX sensory and data processing capabilities, (5) distributed load management, (6) automated and continuous built-in test and MIL-STD-1553 compatible multiplexing using TSPC (Twisted Shielded Par) and F/O (Fiber Optic) data busing techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0041, MIXING OF SWIRLING FLOWS AND BEHAVIOR OF WET FLOWS

G.C. Oates, University of Washington, School of Engineering, Dept. of Aeronautics & Astronautics, *206 Guggenheim Hall, Seattle, Washington* 98105 (DF052130; F49620-78-C-0063)

AF function - advanced turbomachinery. Opportunity - improve our understanding of the flow through an axial flow turbomachine. Objective - to conduct an investigation into 1) the mixing behavior of swirling flows and 2) the effects of water droplets and water vapor on the flow processes within transonic fans. How work contributes - will provide fundamental knowledge needed in order to provide solutions to two constantly reappearing problems of high performance turbomachinery.

An investigation will be conducted in two areas. In the first area, which will study the effect upon mixing by swirling the inner stream of two co-annular streams, the first step will be to construct the required test facility. Once completed, detailed investigations concerned with obtaining data on the mean flow will be carried out. Parameters to be varied will include degree of swirl, pressure gradient and variation in geometric shape of inner annulus. In addition, a theoretical investigation will be carried out with the goal of developing a method capable of predicting the mixing behavior of swirling flows. In the second area, which will study the effect of water droplets and water vapor on the flow processes, the experimental study will study the behavior of water droplets passing through a shock. An extension of Marble's theory would also be undertaken. Results of analysis and experiment would be compared.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0042, REGISTRATION OF DIGITIZED PHOTOS (DA0E9348)

F. Leberl, Technische Universitat Graz, *Rechnauerstrasse 12, Graz, Austria* (DA0G2789; DAJA37-80-0020)

Develop an interactive procedure for registering digitized aerial photographs to digitized base maps of appropriate scale and projection.

Procedure will require: 1) the creation of a data bank so organized as to be appropriate for digitized imagery; 2) the development of pattern recognition routines.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Research & Standardization Group

4.0043, FUNDAMENTAL MODELING OF KINETICS, MIXING AND EVAPORATION IN COMBUSTORS

J. Swithenbank, University of Sheffield, *Mappin St., Sheffield, England, United Kingdom* (DF013410; AFOSR-79-0072)

AF function - advanced airbreathing engines, airborne weapon delivery. Deficiency - insufficient understanding of basic mechanisms and processes involved in advanced airbreathing combustors and lack of realistic guidelines for predicting propulsion system performance and solution of combustor design problems. Objectives - to understand and develop accurate theoretical and mathematical models realistically describing the combustion phenomena encountered in advanced airbreathing ramjet and turbojet combustors and augmentors. How work contributes -will provide additional understanding and realistic analytical modeling of turbulent reactive flow fields not now available and will contribute to establishing realistic design criteria for efficient, stable and low polluting primary and secondary ramjet, turbojet and composite engine combustors. Also will aid in understanding combustion system limitations and hence in system optimization at design stages.

Parallel theoretical and experimental studies associated with modeling of ramjet and gas turbine combustors will be carried out. Emphasis will be on practical application of entrainment and turbulence theory and use of partially and well stirred chemical reactor theory and networks, elliptic finite difference analysis, droplet trajectory analysis and residence time distribution analysis to formulate mathematical phenomenological models capable of predicting local values of the dependent variables in reacting 3-D two-phase flow systems for use in solution of combustor design problems. Studies will also be carried out on techniques of increasing the speed of the finite difference algorithm to permit a reasonable number of cases to be evaluated during design procedures. Included will be study of simultaneous influence of pressure, two-phase fluid dynamics, including rotating flow components in the fuel injector vicinity, turbulence, unmixedness, radiative and convective heat transfer, multiple reaction chemical kinetics, fuel preparation (e.g., droplet break-up, distribution and evaporation), steady and unsteady combustion, turbulent subsonic and supersonic air flows on combustor characteristics and performance. Special attention will be given to application of the combustor analysis methods to dump combustor and ducted rocket configurations of interest

to AFAPL. computation will be made of the 3-D flow patterns, turbulence levels, temperature profiles, etc. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, SEA SURFACE MECHANISMS
G.A. Dawson, University of Arizona, Inst. of Atmospheric Physics, *Tucson, Arizona* 85721 (DN123034; N00014-77-C-0099)

Development of methods of collecting trace gases and constituents in the marine boundary layer and the effect of these traces on fog and aerosol formation and visibility in general is the objective of this research.

The developed collectors are used both at land and marine (St. Nicholas Island) sites to sample the respective environments for trace (ppm) constituents such as calcium, potassium, magnesium, chlorine, sodium and ammonia. The collectors allow high volumes of air to be collected and constituent concentrations to be computed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0002, CHARGED-PARTICLE BEAM INJECTION STUDIES
Unknown, Jaycor, *1401 Camino Del Mar, Del Mar, California* 92014 (DF583530; F19628-79-C-0121)

AF function - satellite survivability and communications. Deficiency - the space-environmental effects of beam injection experiments are not fully understood. Objective - to gain an understanding of the effects on the vehicle and ambient plasma of charged-particle beam injection from a vehicle and the characteristics of the beam in the vicinity of the vehicle. How research contributes -will provide a basis for assessing the effect of charged-particle beam injection into the ionosphere.

Pertinent theory and experiments in the literature will be studied. Effects of charged particle injection in the ionosphere in the vicinity of the vehicle will be calculated. These will include the steady-state and time-dependent vehicle potential, the charge-current emission limitations, secondary electron and ion effects, and the energy spectrum of the beam leaving the vicinity of the vehicle.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0003, ANALYSIS OF STRATOSPHERIC TRANSPORT PROPERTIES
G.D. Nastron, U.S. National Aeronautics & Space Admin., Ames Research Center, *Moffett Field, California* 94035 (DF580480)

AF function - Environmental Impact Statements (EIS) of high altitude Air Force operations. Deficiency - current or anticipated AF operations in the stratosphere and upper troposphere may deposit harmful materials and it is important to assess the potential impact of this. Objective - analyze archived meteorological data of winds, ozone and temperature, 30 to 60 km, and derive eddy diffusion coefficients and ozone flux values. How work contributes - this work will provide improved eddy diffusion coefficients and ozone flux values required for environmental model verification and evaluate lifetime of pollution in the stratosphere.

The statistics of observed winds obtained from rocket soundings are used to estimate eddy diffusion coefficients. Horizontal diffusivity can be estimated from variance of the meridional wind and its integral time scale. Vertical diffusivity is estimated from the wavelengths of the small scale disturbances observed in the mean wind profile. The ozone transient eddy flux values required for model verification will be obtained from ozonesonde data correlated with the wind data. The mean flux can be computed directly from the ozone data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0004, THE NONLINEAR RESPONSE IN A BAROCLINIC MODEL TO STATIONARY FORCINGS
J.O. Roads, University of California, San Diego Campus, Graduate School, *P.O. Box 109, La Jolla, California* 92037 (NAG 5-105)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0005, SCIENTIFIC INVESTIGATIONS FOR THE EARTH RADIATION BUDGET EXPERIMENT (ERBE)
T.H. Vonderhaar, Colorado State University, School of Engineering, Dept. of Atmospheric Science, *Fort Collins, Colorado* 80523 (NAS 1-16465)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0006, STUDY OF THE ULTRAVIOLET OZONE SPECTROMETER FOR THE UPPER ATMOSPHERE RESEARCH SATELLITES (UARS)
G.H. Mount, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Physics, *1200 University Ave., Boulder, Colorado* 80302 (NAS 5-26170)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0007, STUDY OF THE ULTRAVIOLET SOLAR SPECTRAL IRRADIANCE EXPERIMENT FOR THE UPPER ATMOSPHERE RESEARCH SATELLITES (UARS)
G.J. Rottman, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Physics, *1200 University Ave., Boulder, Colorado* 80302 (NAS 5-26172)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0008, SCIENCE SUPPORT FOR EARTH RADIATION BUDGET SATELLITE/STRATOSPHERIC AEROSOL AND GAS EXPERIMENT
D.G. Murcray, University of Denver, School of Arts & Sciences, Dept. of Physics, *2115 S. University Blvd., Denver, Colorado* 80210 (NAS 1-16306)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0009, INVESTIGATION OF THE TRANSMISSION OF INFRARED RADIATION THROUGH THE EARTH'S ATMOSPHERE
D.G. Murcray, University of Denver, School of Arts & Sciences, Dept. of Physics & Astronomy, *2115 S. University Blvd., Denver, Colorado* 80210 (9-315; NA79AA-D-00021)

OBJECTIVE: To develop techniques for inverting satellite infrared solar occultation measurements to obtain distributions of concentrations of trace gases in the stratosphere; and to optimize spectral channels for remote temperature sounding.

APPROACH: The University of Denver will use their high-resolution infrared spectra, taken in the laboratory and in the stratosphere, to search for significant spectral lines that have not yet been documented in the literature. They will compare measurements of transmittances with line-by-line calculations. They will develop band models for the gases that the line-by-line method cannot treat. In addition, they will perform calculations of upwelling radiances in the spectral intervals of the HIRS and AMTS temperature sounders. These radiances will be used in a joint NOAA/NASA study to compare the accuracies of temperature retrievals from the two sounders.

PROGRESS: An atlas of 1339 methane lines, many not previously documented in the literature, was prepared from

measurements of CH4 spectra between 1120 and 1800/cm. Line intensities were determined on the basis of line-by-line calculations in this region.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0010, RESEARCH RELATIVE TO A CLIMATICALLY-DERIVED GLOBAL SOIL MOISTURE DATA SET
C.J. Willmott, University of Delaware, School of Arts & Sciences, Dept. of Geography, *Newark, Delaware* 19711 (NAG 5-107)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0011, INVERSE PROBLEMS IN SCATTERING AND GEOPHYSICS
V. Barcilon, University of Chicago, School of Physical Sciences, Dept. of Geophysical Sciences, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (DN575174; N00014-76-C-0034)

Inverse problems arise in problems in which information is desired about a scattering obstacle, a source distribution or an inhomogeneity of a medium from remotely sensed data. Naval applications include reconstruction of a scattering obstacle (ship, aircraft, missile), with sufficient accuracy for classification and identification purposes, reconstruction of sound-speed profiles in the ocean, design of antennas from the desired farfield pattern and identification of location and size and shape of objects buried in the earth or submerged in the water. The objective of this task is to develop mathematical methods for treating inverse problems.

Numerical and analytic techniques will be developed to treat inverse eigenvalue problems. Applications considered will be primarily from geophysics and inverse scattering.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0012, STUDY THE EFFECT OF CLOUD INHOMOGENEITY ON THE EARTH RADIATION BUDGET
R. Davies, Purdue University, School of Science, Dept. of Geosciences, *Executive Bldg., West Lafayette, Indiana* 47907 (NAG 5-101)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0013, PARAMETERIZATION OF CLOUD EFFECTS ON THE ABSORPTION OF SOLAR RADIATION
R. Davies, Purdue University, School of Science, Dept. of Geosciences, *Executive Bldg., West Lafayette, Indiana* 47907 (NAG 5-106)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0014, ENERGETIC STUDY OF THE GODDARD LABORATORY FOR ATMOSPHERIC SCIENCES GENERAL CIRCULATION MODEL
T.C. Chen, Iowa State University of Science & Technology, School of Sciences & Humanities, Dept. of Earth Sciences, *Beardshear Hall, Ames, Iowa* 50010 (NAG 5-104)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0015, INTERNATIONAL SUN EARTH EXPLORER A AND B DATA REDUCTION AND ANALYSIS
L.A. Frank, University of Iowa, School of Liberal Arts, Dept. of Physics & Astronomy, *Jessup Hall, Iowa City, Iowa* 52240 (NAS 5-26257)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0016, CROP PHENOLOGY AND LANDSAT-BASED IRRIGATED LANDS INVENTORY IN THE HIGH PLAINS
E.A. Martinko, University of Kansas, Lawrence Campus, School of Liberal Arts & Sciences, Dept. of Geography & Meteorology, *112 Bailey Hall, Lawrence, Kansas* 66045 (NAG 2-57)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0017, NAVY ENVIRONMENT ARCTIC BASIN BUOY PROGRAM
R. Fleming, U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., *6010 Executive Blvd., Rockville, Maryland* 20852 (DN075246; N00014-80-F-0042)

The objective is to measure atmospheric pressure, temperature and ice motion at a grid of points representative of the entire arctic basin for a five-year period mid-1980 to mid-1985, from which data the behavior of sea ice and its effects upon climate, as well as its influence on arctic sea ice remote sensing imagery can be determined.

Deploy an array of approximately 15 arctic remote data buoys on a 500 km grid patterned after the arctic buoy array established under the FGGE program. Air droppable buoys which telemeter their data to a collection point via the Tiros-N-Argos net will be utilized. Data will be available via the global telecommunications service net within approximately three hours after collection.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0018, COMPARATIVE ANALYSIS OF WALLOPS WIND AND WEATHER DATA - WIND AS A POWER SOURCE ON THE EASTERN SHORE
E.W. Chapin, University of Maryland, Eastern Shore, Undergraduate School, Dept. of Mathematics & Computer Science, *Princess Anne, Maryland* 21853 (NAG 6-6)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Wallops Flight Center

5.0019, ANALYSIS OF SPACECRAFT CHARGING SATELLITE DATA
D. DeLorey, Boston College, Chestnut Hill Campus, Graduate School, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (DF582320; F19628-79-C-0018)

AF function - communications, navigation and surveillance. Deficiency - lack of adequate methods of predicting geophysical conditions with the AF operating environment and their probable effects on the success of future AF operations. Objective - analysis and interpretation of environmental data collected from high altitude research satellite. How research contributes - leads to reliable methods for predicting geophysical conditions.

Develop and implement mathematical techniques and analytical routines to analyze geosyncronous space probe data to produce unified compacted geophysical data bases for integrated investigations of the spacecraft charging/discharging and plasma interaction phenomena.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0020, MATH AND PHYSIC STUDIES
N. Grossbard, Boston College, Chestnut Hill Campus, Graduate School, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (DF582640; F19628-79-C-0063)

AF function - 1. Missile guidance, 2. Trans-ionospheric communications, 3. Infrared optical detection systems, 4. Reconnaissance - target acquisition and tracking. Deficiency or opportunity - 1. Lack of detailed knowledge of the gravity field contributes to missile guidance error, 2. Present models of the photoelectron flux are not accurate enough to permit remote satellite monitoring, 3. Lack of knowledge of the optical and infrared emissions induced by the detonation of high altitude nuclear weapons, 4. The performance of any optical system looking through the atmosphere is degraded by atmospheric light scattering. Objective - 1. Determine global gravity field with

maximum accuracy and precision, 2. To model approximate cross sections and to calculate the photoelectron flux, 3. To measure the spectral emissions induced in the atmosphere by electron accelerators, 4. Study the intensity of solar radiation. How research contributes - 1. reduction of geodetic and gravity errors will lead to improved guidance performance, 2. The contribution of the photoelectron flux studies is to provide a more accurate specification and understanding of ionospheric properties so as to enhance the capabilities of current and future AF systems, 3. The measurement of the spectral nature of the atmospheric emissions induced by nuclear weapons will improve the infrared optical detection systems, 4. Achieving the objective of this study will lead to an improved capability to predict the effects of the atmosphere on EO systems.

Mathematical studies and numerical algorithms will be applied to properly analyze and test the models related to the above systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0021, NAVY ENVIRONMENT - CORRELATION OF ONSHORE/OFFSHORE AND LONGSHORE SEDIMENT TRANSPORT IN COASTAL WATERS

B.M. Brenninkmeyer, Boston College, Chestnut Hill Campus, School of Arts & Sciences, Dept. of Geology & Geophysics, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (DN675490; N00014-76-C-0819)

The purpose of this research is to differentiate onshore/offshore and longshore sediment movement in surf zone and shallow continental shelf waters. Although known to be of greater magnitude than longshore transport, onshore/offshore transport is still poorly understood, both qualitatively and quantitatively. An understanding of onshore/offshore sediment transport is essential to the development of an accurate bottom feature prediction capability. This research will thus have a direct impact on improved Navy/Marine Corps amphibious and mine deployment/retrieval operations.

A series of field investigations will be performed at several sites along the east coast of the United States. Pressure sensors, current meters and almometers will be deployed in order to measure both onshore/offshore and longshore sediment transport and to make direct correlations with water velocities and wave elevations.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0022, COMPUTATIONS OF SEA SURFACE MICROWAVE BRIGHTNESS TEMPERATURE

J. Alishouse, Geo Atmospherics Corp., *P.O. Box 177, Lincoln, Massachusetts* 01773 (7-631; M0-A01-78-00-4010 MOD.#3)

OBJECTIVE: The objective of this study is to develop a mathematical model and appropriate computer codes that will permit the computation of antenna temperatures from microwave radiances for a finite field-of-view and compare them with actual measurements.

APPROACH: Utilizing the antenna pattern of the Seasat Scanning Multichannel Microwave Radiometer (SMMR), and geophysical parameters, the contractor has developed a mathematical model which performs the necessary integration over the field-of-view defined by the antenna pattern. This model has been coded in a programming language which will permit its operation on a variety of NOAA computers. Results of these computations will be compared with actual SMMR measurements.

CURRENT PLANS: SMMR antenna temperatures will be compared to data obtained during the Gulf of Alaska Experiment and the Joint Air-Sea Interaction Experiment. Additional computations will be performed to assess partial beam filling effects such as sun glint, precipitation and clouds and land/ocean ratios.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0023, LASER SPECTROSCOPY STUDY

R. Eng, Laser Analytics Inc., *38 Hartwell Ave., Lexington, Massachusetts* 02173 (DF248490; F19628-77-C-0015)

AF function - target detection, surveillance, reconnaissance, communication, laser transmission. Deficiency - the dependence of the transmission of the atmosphere in spectral windows on atmospheric constituents and environmental conditions is poorly understood. Objective - perform experimental measurements to determine the dependence of atmospheric transmission on environmental conditions, with emphasis on the spectral window regions of high transmission.

Tunable diode laser spectroscopy will be performed in the atmospheric window regions to obtain precise determination of spectral positions, strengths and shapes of atmospheric lines. How research contributes - the results of this research will have direct application to the continuum and weak line transitions in the AFGL modelling codes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, JOINT US-USSR MID-OCEAN DYNAMICS EXPERIMENT (POLYMODE) - THEORETICAL STUDIES OF LAGRANGIAN KINEMATICS AND DYNAMICS AND GULF STREAM RINGS

G.R. Flierl, Massachusetts Inst. of Technology, School of Science, Dept. of Meteorology, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (OCE77-28350 A02)

This project is part of POLYMODE. The long range goal of POLYMODE is to understand the role of the mesoscale eddies in the general circulation of the ocean.

This project includes theoretical work on two separate but overlapping problems in mesoscale oceanic theory: Lagrangian kinematics and dynamics, and Gulf Stream Ring modelling. The Lagrangian problems study the movements of submerged floating particles such as Sofar floats, water with special chemical or temperature-salinity characteristics, or biological matter. The kinematic studies deal with the trajectories of particles in a given flow field (e.g. the velocity field of a moving Gulf Stream Ring) or in a turbulent flow field with given statistics. The dynamical studies will consider the simplification of the Lagrangian equations of motion under the standard constraints characterizing mesoscale motions--long time and length scales and dominantly geostrophic, hydrostatic force balances. Applications to oceanic experiments will be considered.

The Gulf Stream Ring studies will include calculations of the ability of one of these mesoscale vortices to carry particles along with it as it moves through the ocean. Dynamical models of the rings will be studied to determine which physical effects cause or inhibit translation, distortions of the circular shape, dispersion (formation of neighboring highs and lows by wave radiation), and decay. The existence and properties of 'Solitary waves' with a circular shape will be investigated. In these waves, the nonlinear terms in the equations of motion counteract the terms which tend to cause dispersion, leading to an eddy of a long-lived nature.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Ocean Sciences

5.0025, NAVY ENVIRONMENT - SPACECRAFT OCEANOGRAPHIC REMOTE SENSING

E.L. Mollo Christensen, Massachusetts Inst. of Technology, School of Science, Dept. of Earth & Planetary Sciences, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DN675201; N00014-75-C-0291)

An improved knowledge of the capabilities of spacecraft for remote sensing of the oceans is required if we are to fully utilize these systems for surveillance, as well as non-acoustic and acoustic ASW purposes. The objective of this task is to assess how well passive spacecraft remote sensing techniques can be used to map oceanic features such as fronts, surface expressions of internal tides, and current systems.

The contractor will work, for example, with the Spacecraft Science and Engineering Center at the U. of Wisconsin to look over the extent of archived data; he will work with our contrac-

tors at Scripps and the U. of Miami in defining what ground truth experiments will be needed to identify the features noted in the archived data; and he then will suggest how remote sensing techniques might best be used for oceanographic monitoring purposes. He will also examine current meter records from the gate area for possible internal wave guide effects of the thermocline ridge under the ITCZ.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0026, RESEARCH LEADING TO THE DEVELOPMENT OF INSTRUMENTATION FOR RESEARCH ROCKETS, SUPPORT AND INSTALLATION AT ROCKET LAUNCH SITES

S.J. Rochefort, Northeastern University, School of Engineering, Dept. of Electrical Engineering, *360 Huntington Ave., Boston, Massachusetts* 02115 (DF247220; F19628-76-C-0111)

AF function - research leading to the development of state of the art airborne instrumentation systems. Deficiency - the inability to accurately forecast the atmospheric interactions affecting the design and operation of military systems in the area of rockets and satellites. Objective - to perform studies leading to the design, construction and flight test of state of the art airborne instrumentation systems. Such studies will attempt to improve present day systems by more efficient utilization of transmission bandwidths. Provide field support - carry on post-flight analysis of performance and provide continuing improvement. How research contributes - the development of more efficient airborne data processing techniques and instrumentation systems will allow more efficient use of RF bandwidth within the limited allowed band.

Theoretical development of more efficient telemetry systems for use in rocket, satellite and balloon instrumentation systems. Construct these telemetry systems for flight - provide field support - carry on post-flight analysis of performance. The closed loop will ensure rapid response to current needs. The design objectives concern space, weight and power. The vast experience accumulated through previous contracts should ensure efficient use of valuable Air Force funds.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, ATMOSPHERIC DENSITY MEASUREMENT IN THE MIDDLE ATMOSPHERE 13870-GSX

F.B. Sellers, Parametrics Inc., *221 Crescent St., Waltham, Massachusetts* 02154 (DA0E9099; DAAG29 76 C 0041)

To design and fabricate an instrument utilizing beta radiation to measure atmospheric density to an elevation of 100 kilometers. Precise spatial and temporal variations in density are very important parameters in calculations for reentry of missiles in the atmosphere. An instrument capable of making the necessary measurements is proposed. The proposal also has broader relevance as a unique approach to direct sensing of atmosphere density.

The first phase of the research involves investigation of satisfactory beta radiation sources and detection. Space simulation chambers will be used to measure and calculate the density response to beta radiation. Based on the results, a density sonde will be designed and fabricated in the second phase of the work.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

5.0028, STUDY OF ENERGY BALANCE AND PLASMA MOTIONS IN THE IONOSPHERE

A. Dalgarno, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (DF581840; F19628-78-C-0047)

AF function - surveillance, communication, navigation, ionosphere and magnetosphere modelling. Deficiency - inadequate knowledge of energy balance and plasma motions in the ionosphere for the design of AF communication and navigation systems. Objective - development of theoretical and computational techniques for the calculation of quantities pertaining to the energy balance and plasma motions in the ionosphere including the effects of particle precipitation and electric fields. Satellite measurements shall serve as inputs to calculations and as a test of the validity of the theory. How research contributes -provides data and analysis essential for the design and maximum utilization of communications, guidance and surveillance systems such as the defense satellite communication system, AF SAT COM II, 414l. The work provides an understanding of the dynamical processes in the ionosphere.

Study theoretical and computational procedures for calculation of energy balance, plasma motions and electrical conductivities on a global basis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0029, THE MORPHOLOGY OF STRATOSPHERIC PLANETARY WAVES

A.D. Belmont, Control Data Corp., *8100 34th Ave. S., Minneapolis, Minnesota* 55420 (DF051290; F49620-78-C-0036)

AF function - long range forecasting of meteorology and the state of the ionosphere are required to support flight and communications systems. Deficiency - little is understood of the dynamics of the upper stratosphere and mesosphere. Yet evidence is mounting that planetary wave patterns in that region are precursors of tropospheric changes. Ionospheric/tropospheric coupling, a popular topic, also suggests some interaction with that region of interest. Objective - to determine the planetary wave patterns in the stratosphere (16-55 km) during the period 4/70 to 12/76 from satellite radiance data and to diagnose their spatial and temporal variations. Coupling with other layers is not within the scope. Contribution - improve understanding of the stratosphere, aid communications, possibly aid forecasting.

Satellite radiance data will be analyzed using regression techniques and available rocketsondes to determine average temperature in their stratospheric layers EQ (3-13 km). These spatial and temporarily distributed data will be spectrally analyzed to determine the contributions of wave numbers 1-6.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0030, MICROPULSATION RESEARCH AT ROBERVAL, QUEBEC, AND AT SIPLE AND SOUTH POLE, ANTARCTICA

L.J. Cahill, University of Minnesota, Minneapolis Campus, Space Science Center, *Morrill Hall, Minneapolis, Minnesota* 55455 (DPP79-23294)

During the period 1980-82, search-coil magnetometers will continue to be operated at the geomagnetically conjugate stations at Siple, Antarctica, and Roberval, Quebec, Canada, which are ideally situated for micropulsation studies in that they are 'quiet sites' and are at magnetic latitudes well situated for exploration of the plasmapause region of the earth's magnetosphere. In addition a new micropulsations station will be installed at the Amundsen-Scott Station at South Pole in the austral summer of 1980-81.

The micropulsation data obtained with these magnetometers along with data obtained by other ground-based passive and active techniques and by satellites will be used to study (1) the generation and propagation of micropulsations, (2) the propagation of micropulsation through the ionosphere under varying seasonal solar and local time condition, (3) the dispersive properties of the magnetospheric medium, and (4) the stimulation of micropulsations by the VLF transmitter at Siple and (5) high latitude cusp phenomena.

This is a continuation of NSF grant number DPP 77-21924.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0031, RESEARCH OF THE RELATIONSHIP BETWEEN GRAVITY AND BATHYMETRY IN THE PACIFIC OCEAN
T.S. Watts, Columbia University, Graduate School of Arts & Sciences, Dept. of Geological Sciences, *Broadway & W. 116th St., New York, New York* 10027 (NAG 5-98)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0032, NAVY ENVIRONMENT - GEODESY OF THE OCEAN BASINS
M. Talwani, Columbia University, Lamont Doherty Geological Observatory, *Palisades, New York* 10964 (DN975873; N00014-75-C-0210)

The accuracy in the prediction of trajectories of ballistic missles and in the determination of a ship's position is determined by limitations in knowledge of the earth geoid. This task will determine a better geoid for the oceans from 72 S to 72 N latitude.

The geoid will be mapped using satellite altimetry and will be calculated from sea surface gravity measurements. Density distributions within the earth, which cause undulations in the geoid, will also be determined.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0033, SCIENCE SUPPORT FOR THE EARTH RADIATION BUDGET EXPERIMENT (ERBE)
R.D. Cess, State University of New York, Stony Brook Campus, School of Engineering & Applied Sciences, Dept. of Mechanical Engineering, *Stony Brook, New York* 11794 (NAS 1-16444)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0034, SUPPLEMENTAL METEOROLOGICAL INSTRUMENTATION FOR INCIDENT RESPONSE
P. Michael, U.S. Dept. of Energy, Brookhaven National Lab., *Upton, New York* 11973 (A-3317)

The objective is to evaluate types of supplemental meteorological instrumentation needed for incident response at nuclear power plant sites. An evaluation of off-the-shelf meteorological instrumentation (including both direct and remote sensors) and data acquisition systems (including the capabilities of other Federal agencies) to supplement the on-site meteorological program and other locally available systems will be performed. Instrumentation should be portable, capable of being deployed in minimal time frame, and provide useful information for emergency planning and evacuation.

SUPPORTED BY U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation

5.0035, A REMOTE SENSING TECHNIQUE FOR ESTIMATING WATERSHED RUNOFF
O. Mintzer, Ohio State University, Columbus Campus, School of Engineering, Dept. of Civil Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (A-063-OHIO)

The proposed research will provide a technique which is expected to be more economical than a current technique used to predict runoff from ungaged watersheds, thus minimizing the effort to describe a watershed's surface characteristics.

The proposed objective is to derive from automated remote sensing data the input parameters to the Chow formula for predicting runoff from agricultural watersheds. The capabilities of satellite multispectral data to define ground surface conditions and soil type will be investigated.

Computer compatible tapes produced by LANDSAT 2 and 3 along with other data sources will create a multispectral-multitemporal acquisition process for aiding the analysis and classification of cover types, surface conditions and soil types. Pattern recognition techniques will be designed to provide measurements of unidentified areas; a classifier will be designed for every class. Control data will provide verification of classification results. A digital color coded map will show the spatial distribution of runoff areas. This approach will provide a more economical technique for dealing with runoff from ungaged drainage basins.

SUPPORTED BY U.S. Dept. of the Interior, Office of Water Research & Technology

5.0036, SCIENTIFIC INVESTIGATIONS FOR THE EARTH RADIATION BUDGET EXPERIMENT (ERBE)
F.B. House, Drexel University, School of Science, Dept. of Physics & Astrophysics, *32nd & Chestnut Sts., Philadelphia, Pennsylvania* 19104 (NAS 1-16428)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0037, LIDAR ENGINEERING STUDY
Unknown, General Electric Co., *3198 Chestnut St., Philadelphia, Pennsylvania* 19101 (DF584070; F19628-80-C-0062)

AF function - vehicle tracking, RV trajectory, prediction, interception, satellite reentry. Deficiency - insufficient information on a timely basis of atmospheric density and its variations in the lower and middle atmosphere as required by advanced reentry systems and in the lower thermosphere for satellite reentry predictions. Objective -development of lidar sounder for remote sensing of atmospheric properties and monitoring the density and temperature of the middle atmosphere. How research contributes - lidar techniques have potential to provide density and temperature measurements in the atmosphere (15-105 km) with resolution and accuracy comparable to present rocket-borne meteorological sensors. In addition to cost benefits, remote sensing techniques such as lidar are the only adequate means for obtaining sufficient synoptic data for mesospheric studies.

Current laser technology has demonstrated the feasibility of this application. Engineering design study and evaluation will be conducted towards the development and fabrication of a laboratory operated lidar system to be later packaged into a transportable unit for studies at different geographic locations in conjunction with radar backscatter measurements and rocket field programs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0038, STUDY OF THE IMAGING STRATOSPHERIC ULTRAVIOLET SPECTROMETER FOR THE UPPER ATMOSPHERE RESEARCH SATELLITE (UARS)
D.G. Torr, Utah Higher Education System, University of Utah, Graduate School, *310 Park Bldg., Salt Lake City, Utah* 84112 (NAS 5-26171)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0039, CONTINUING THEORETICAL INVESTIGATIONS OF PLASMA AND NEUTRAL GAS TRANSPORT PROCESSES IN THE IONOSPHERE
R.W. Schunk, Utah Higher Education System, Utah State University, Center for Research in Aeronomy, *Main Bldg., Office 104, Logan, Utah* 84321 (ATM78-10501)

This grant funds theoretical investigations of the effects that plasma and neutral gas transport processes have on planetary ionospheres and atmospheres. Specifically, this work will: 1) derive diffusion and heat flow equations for a planetary ionosphere which are valid when there are large temperature differences between the interaction species, 2) derive a general system of transport equations which is based upon a bi-Maxwellian distribution function, 3) calculate time-dependent He ion density, temperature, and drift velocity profiles in the polar cap with allowance for heating due to convection electric fields, 4) study the dynamics of the high latitude F-layer with emphasis on understanding the composition changes that occur in the nightside electron density trough regions, 5) study plasma transport in the ionosphere above Stable Auroral Red arcs (SAR arcs) with the complete 13-moment system of transport equations, 6) obtain a numerical solution of the 13-moment of transport equations for the solar wind (H ion electrons) and the terrestrial polar wind (H ion, O ion electrons), and (7) obtain a nu-

merical solution of the 13-moment system of transport equators for the neutral atmosphere.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0040, KINEMATIC ANALYSIS OF TROPICAL CYCLONES USING SATELLITE WIND MEASUREMENTS
W.M. Frank, University of Virginia, School of Arts & Sciences, Dept. of Environmental Sciences, *Garrett Hall, Charlottesville, Virginia* 22903 (NAG 5-102)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0041, SCIENTIFIC INVESTIGATIONS FOR THE EARTH RADIATION BUDGET EXPERIMENT (ERBE)
D.L. Hartman, University of Washington, School of Arts & Sciences, Dept. of Atmospheric Science, *Seattle, Washington* 98105 (NAS 1-16462)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

5.0042, NAVY ENVIRONMENT - CLIMATE REFERENCE DATA
S. Hastenrath, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Meteorology, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DN875342; N00014-78-C-0190)

The purpose of this research is to put together the background climatology of the Indian Ocean and surrounding land areas as a supplement to the already assembled climatology for the tropical Atlantic and adjacent areas. Anomalous climatological data shall be included in such a way that it be used for experimental forecasts of climatological departures from long term means. This research is relevant to the problem of improving the long range meteorological forecast.

The climatology to be assembled is to contain a set of meteorological variables including sea level pressure, several wind parameters including steadiness, divergence, vorticity curl of wind stress, sea surface temperature, air temperature, cloudiness and precipitation frequency. Additionally, the climatology shall also contain the variables applicable to estimates of the heat budget of the Indian Ocean. These are the net short and long wave radiation at the sea surface, the sensible and latent heat flux at the air sea interface, and heat export and storage in the ocean.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0043, SCIENCE SUPPORT FOR EARTH RADIATION BUDGET SATELLITE/STRATOSPHERIC AEROSOL AND GAS EXPERIMENT
T.J. Pepin, University of Wyoming, School of Arts & Sciences, Dept. of Physics, *P.O. Box 3435, University Station, Laramie, Wyoming* 82070 (NAS 1-16305)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, RESEARCH COUNTERMEASURES FOR SIGNIFICANT MEDICAL HAZARDS IN MILITARY SYSTEMS (DA0C6896)
J.L. Haley, U.S. Dept. of Defense, Army, Medical Research & Development Command, Field Research & Biomedical Applications Div., *Fort Rucker, Alabama* 36362 (DA0G0165)

Conduct applied medical research to identify, assess and prevent unnecessary health hazards and personnel injuries imposed by exposure to the operational environment (altitude pressures, heat, cold, noise, toxic gases, oxygen levels, overblast pressures, chemical and biological agents, vibration, acceleration and deceleration impacts), and to provide the Army technical information, recommendations and standards to be used in the development and modification of systems that provide protection from those hazards.

The approach involves the application of physiological and biomedical applied research methods utilizing physical and anthropometric examinations, X-rays, biochemistry, EMG muscle stress measurement and dynamic impact analysis techniques to isolate the hazards involved and determine required protective measures. These techniques will be applied to the establishment of biomedical requirements of orthopedically designed seat configurations, head impact protection, vehicle crashworthiness, body restraint systems, environmental control systems, oxygen generating systems, life support survival equipment and aeromedical evacuation and rescue equipment.

SUPPORTED BY U.S. Dept. of Defense, Medical Research & Development Command, Aeromedical Research Lab.

6.0002, STRESS AND PERFORMANCE IN THE FLYING TRAINING ENVIRONMENT
Kvahenbaul, Arizona State University, Graduate School, *Tempe, Arizona* 85281 (DF224200; F33615-78-C-0053)

To investigate stress in the flying training environment with particular interest directed to stress of simulated flight and subsequent stress of airborne events. Experiments have been planned which (1) allow for quantification of stress experienced in various modes and phases of surface attack training, (2) help determine the interaction of instructor techniques and student stress, and (3) provide a clearer picture of the relationship between stress, learning and performance in surface attack training.

Three studies will examine: (1) physiological indices of stress in A-10 surface attack training, (2) the effect of IP teaching style on student stress, (3) the effect of combat experience on stress response to simulated A-10 scenarios.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0003, DEVELOPMENT AND EVALUATION OF ADVANCED INSTRUCTIONAL FEATURES METHODS IN ASPT
R. Hughes, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF224020)

1. To develop through active experimental manipulation effective applications of ASPT advanced instructional features to air-to-surface training. 2. To identify factors affecting the effective management of ASPT advanced instructional features within the context of A-10 air-to-surface training. 3. To develop and evaluate candidate measures of instructional effectiveness.

Two phases are proposed. Phase I is a developmental phase in which a series of mini-studies will be conducted to identify promising applications of ASPT instructional features in the training of air-to-surface attack skills on the A-10. The emphasis in Phase II represents a shift in focus from the student to the instructor and the manner in which the instructor is able to utilize the instructional features as an aid to training. A chief concern in Phase II will be upon the instructor's allocation of instructional time and practice time and the effects of such allocation upon student performance. Measures of effectiveness such as performance gain per unit of instructional time will be evaluated for their sensitivity to different strategies of employing advanced instructional features.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0004, CONTRIBUTION OF MOTION TO TRAINING
E.L. Martin, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Williams Air Force Base, Chandler, Arizona* 85224 (DF222010)

1. To determine the contributions of simulator motion to the acquisition of flying skills for the purposes of identifying the most cost-effective hardware configurations for utilization of ex-

isting systems and for future procurement. 2. To develop a measurement methodology for determining the effects of motion on performance during skill acquisition.

The contact flying skill of the T-37 phase of UPT training has been categorized into four areas: 1. Basic contact skills, 2. takeoff/landing skills, 3. Aerobatic skills, and 4. Formation skills. A series of experiments will be conducted to determine the contributions of simulator motion to these skill areas. The development of the studies will follow a branching logic in which the most costly configurations are compared with the least costly. Intermediate configurations would be investigated in the event that the most costly were found to be significantly superior. All studies will employ a transfer of training paradigm using T-37 UPT students as subjects. The advanced simulator for undergraduate pilot training (ASUPT) will be used for the simulator training phase of each study.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0005, WASHOUT EFFECT IN R. A. TRACKING

H. Jex, Systems Technology Inc., *13766 S. Hawthorne Blvd., Hawthorne, California* 90250 (DF320760; F33615-77-C-0508)

Considering the increased use of moving base simulators in the Air Force, the requirement for better simulator design criteria based upon human operator technology is timely, but more research is needed in this area. A continuing effort to develop this type of simulation criteria technology is being pursued by AMRL (EM). A significant portion of moving base simulator design is the use of washout circuits to limit simulator motion. A criteria that can be linked to pilot performance is desirable. The objective of this research effort is to formulate an experiment that can accomplish this in the roll axis, perform the experiment, collect data and analyze the data. From the results, optimum washout design criteria and human operator models for the roll axis will be formulated. The results of this effort are needed by AFHRL, AFFDL, and AMRL for improved design of motion base simulators.

The contract with Systems Technology, Inc. was extended to include phase 7-tie in with lamars simulator for the purpose of designing, participating in the conduct of, analyzing, and documenting a sway axis washout/coordination experiment on the AFFDL lamars simulator. A purchase request has been submitted to further extend the contract to include phase 8-DES transient motion experiment, for the purpose of assisting in the upgrade of the AMRL des simulator dynamics and in the design, conduct, analysis, and documentation of a follow-up roll axis washout experiment.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0006, FEASIBILITY STUDY OF USING FIELD EFFECT TRANSISTOR TO MEASURE ELECTRICAL FIELD STRENGTH

Y.C. Wang, Howard University, School of Engineering, Dept. of Electrical Engineering, *2400 6th St. N.W., Washington, District of Columbia* 20001 (NAG10-2)

SUPPORTED BY U.S. National Aeronautics & Space Admin., John F. Kennedy Space Center

6.0007, THE HUMAN FACTORS OF AVIONIC COMPUTERS

R.A. Chechile, Tufts University, Medford Campus, School of Arts & Sciences, Dept. of Psychology, *Medford, Massachusetts* 02155 (NAG 2-51)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0008, AN ATTEMPT TO LOCALIZE AND IDENTIFY THE GRAVITY SENSING MECHANISM OF PLANTS

R.S. Bandurski, Michigan State University, School of Agriculture & Natural Resources, Dept. of Botany & Plant Pathology, *Soil Science Bldg., East Lansing, Michigan* 48823 (NAGW 97)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

6.0009, EFFECTS OF SLEEP DEPRIVATION ON THE CENTRAL NERVOUS SYSTEM

A.K. Sinha, College of Medicine & Dentistry of New Jersey, Rutgers Medical School, School of Medicine, Dept. of Physiology, *Box 101, Piscataway, New Jersey* 08854 (DF051050; AFOSR-78-3532)

AF function - Air Force operations expose personnel to a wide range of physiological stresses including prolonged missions with altered work/rest cycles. Varying levels of fatigue and performance degradation may occur as a result of such conditions and thus could impact on the efficiency of aircrewmembers and support personnel. Deficiency - sleep loss and fatigue due to extended missions occur in many Air Force operations. The ability to reduce crew rest requirements would be a significant application of this research effort. Objective - it is generally accepted that dramatic and incapacitating behavioral changes take place in human subjects due to prolonged sleep deprivation. It is assumed that the behavioral decrement due to sleep loss is a consequence and symptomological expression of cellular and subcellular level changes taking place in the brain cells during the deprivation period. The long term objective is - to detect and describe some of these changes, to explore the possibility of reversing them (thereby reversing or minimizing the functional decrement) by chemical intervention and, to determine if qualitatively same biochemical changes take place during cyclic alterations between normal sleep and wakefulness. How research contributes - this research will provide essential information on the effects of sleep deprivation on central nervous system integrity. Findings will be applied to the establishment of rest recovery procedures for flight crews/support personnel and will feed into related ongoing in-house 6.2 efforts at USAFSAM.

A variety of stressful situations is known to stimulate neuroprotease (lysosomal) activity. This generalization suggests that neuroprotease activity in brain will increase following sleep deprivation. A number of conditions (exercise, starvation, infection, hypoxia) and chemicals (progesterone, vitamin a, hyperbaric oxygen) are known to cause simultaneous increase in neuroprotease activity and sleeping time. Based on these observations this effort proposes the following working hypothesis. Prolonged wakefulness or sleep loss increases neuroprotease activity, which causes subcellular disorientation in brain cells and is behaviorally manifested in sleepiness and associated behavioral decrement. This hypothesis will be further tested by light and electron-microscopic survey of morphological changes in brain cells. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0010, EFFECT OF MORPHOLOGICAL AND MECHANICAL PARAMETERS OF ION SPUTTERS MATERIALS ON THE GINGIVAL SEAL OF AN ORAL IMPLANT MODEL

T. Hottel, Case Western Reserve University, Graduate School, *2040 Adelbert Rd., Cleveland, Ohio* 44106 (NAG 3-115)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

6.0011, CONSULTATION ON TOXIC ECOLOGICAL EFFECTS AND ENVIRONMENTAL IMPACT

C.B. Harrah, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF320480)

The objectives of this effort are: (1) to assist users of Air Force chemicals with interpretation of data related to the ecological aspects of their operations, (2) to lend technical assistance and provide professional advice to organizations preparing

environmental impact statements or assessments (3) to assist the surgeon general in responding to requests for review of criteria documents from NIOSH and EPA, and (4) to maintain contact with academic institutions, industry, and other governmental agencies in order to keep abreast of the state-of-the-art in environmental research.

To provide technical and professional advice to any Air Force organization preparing environmental impact statements or assessments when chemical pollution is a major concern. Close liaison will be maintained with EPA to keep abreast of environmental quality standards and criteria requirements. When the National Academy of Sciences establishes its board on environmental quality, continuous contact will be established for assistance in setting environmental quality standards.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0012, RESEARCH AND DEVELOPMENT OF AN ARTIFICIAL FINGER JOINT GROMMET USING ION THRUSTER TECHNOLOGY

J.B. Park, Clemson University, School of Physics Mathematics & Biological Sciences, Dept. of Bioengineering, *Long Hall, Clemson, South Carolina* 29631 (NAG 3-116)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

6.0013, TECHNIQUES FOR ASSESSING G-RELATED PATHOLOGY IN PILOTS OF HIGH-PERFORMANCE AIRCRAFT

E.B. Smith, Technology Inc., *16821 Buccaneer, Suite 206, Houston, Texas* 77058 (DF323760; F33615-78-C-0614)

The myocardial infarctions that go unrecognized each year in the general population and the cardiomyopathy and subendocardial hemorrhage detected recently in swine exposed to acceleration stress make it imperative to develop a diagnostic tool to detect this damage if it exists in aircrew of high performance aircraft. An analytical biochemical technique that correlates with myocardial injury will be developed.

The experimental protocol of this task is divided into four parts-(1) select the most appropriate analytical method for serum creatine phosphokinase isoenzymes and other chemical indicators to validate myocardial injury, (2) correlate laboratory induced myocardial injury with these selected chemical indicators, (3) correlate myocardial damage resulting from plus gz acceleration stress as in part 2, and (4) compare changes in isoenzymes concentrations in human subjects exposed to plus gz acceleration.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

6.0014, SPATIAL RESOLUTION THRESHOLDS DURING THE COURSE OF DARK ADAPTATION

P. Speros, Texas Tech University, Graduate School, *251 Administration Bldg., Lubbock, Texas* 79409 (DA0C7888; DAMD17 77 C 7007)

The object of this research is to determine the visual capability of aircrew at different times during recovery from image intensifier adaptation. Optical image intensifiers serve to aid night vision by amplifying the amount of light reaching the retina. The result is an improvement of visual capability employing night vision devices. If the night vision device fails, as they do without warning, the operator will suddenly find himself visually imparired because of his elevated adaptation level. The time for fully recovery of dark adapted vision varies from one to three minutes, depending upon the mean luminance preceeding the device failure. This research will determine visual capability of the operator at different times during recovery from image intensifier adaptation.

The approach is to measure dark adaptation of five young adult male following adaptation to the chromaticity and luminance levels which spans the range of the AN-PVS 5 night vision optical image intensifier. All experimental parameters will be nested in a 3 (viewing conditions) x 3 (pre-adaptation luminance) x 2 (background luminance) matrix design. Thus, contrast sensitivity functions for selected post-adaptation times generated by determining the contrast threshold at each spatial frequency for a given post-adaptation time can be determined.

SUPPORTED BY U.S. Dept. of Defense, Army, Medical Research & Development Command

6.0015, SUPPORT FOR STATIC AND DYNAMIC ANTHROPOMETRY FOR COMPUTER SIMULATION OF MAN IN A ZERO-G ENVIRONMENT

M.M. Ayoub, Texas Tech University, School of Engineering, Dept. of Industrial Engineering, *P.O. Box 4340, Lubbock, Texas* 79409 (NAS 9-16155)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0016, CAREER PROGRESSION AND PERFORMANCE OF ENLISTED AIR FORCE PERSONNEL

S.A. Brown, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Brooks Air Force Base, San Antonio, Texas* 78235 (DF233030)

To investigate career progression and performance of enlisted personnel during the time period of 1 Jan 70 through 31 Dec 75 at yearly time intervals. Comparisons will be made during the time period to assess similarities between male and female enlistees in an attempt to achieve maximum utilization of female talent and potential and to determine pre-enlistment identifiers of desirable career personnel.

Biographic, attitudinal, and performance data will be compiled from airman record files on yearly input of male and female enlistees (1970-1975). Criterion data of special interest will include disciplinary actions, APRS, unsuitability discharges medical data (if available) and reenlistment. Particular attention will be directed to areas where male and female performance is disparate and to factors which may be related to early separation prior to completion of initial tour of duty. Where sample size is sufficient for meaningful interpretation, analyses will be accomplished by AFSC. Distributional, correlational and regression analyses will be accomplished. Milestones: generation of data base, Nov 76-Sep 77, 11 mos, computer analyses, Oct 77-Apr 78, 7 mos, interpretation of data, May 78-Sep 78, 5 mos, preparation of final report, Oct 78-Jan 79, 4 mos, TR clearance and reproduction, Feb 79-May 79, 4 mos.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0017, ANALYSIS OF PHYSICAL EXERCISE AND EXERCISE PROTOCOLS FOR SPACE TRANSPORTATION SYSTEM OPERATION

A.E. Coleman, University of Houston, Clear Lake City Campus, Graduate School, *2700 Bay Area Blvd., Houston, Texas* 77058 (NAS 9-16136)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, PARALLEL-PROCESSOR SIMULATION SYSTEMS

E.P. O'Grady, Arizona State University, School of Engineering & Applied Sciences, Dept. of Electrical & Computer Engineering, *Tempe, Arizona* 85281 (NAG 3-112)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

7.0002, A STUDY OF WAVE AND BOUNDARY LAYER PHENOMENA IN FLUID SYSTEMS
H.P. Greenspan, Massachusetts Inst. of Technology, School of Science, Dept. of Mathematics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF047210; AFOSR-77-3234)

AF function - aerospace vehicle design and operation. Opportunity - nonlinear fluid flow effects suggest new techniques for design and explanation of flow phenomena. Objective - an understanding of nonlinear fluid motions and their physical and technological implications. How work contributes - by suggestive examples exhibiting and quantifying relevant nonintuitive effects.

The several approximations to the nonlinear partial differential equations of viscous fluid flow are treated analytically, by boundary layer techniques and numerically to obtain solutions to boundary value problems which model transition to turbulence, wave interactions, instability and separation in a rotating fluid, stratified flows, waves on deformable boundaries, droplet behavior and storage tank rupture.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

7.0003, SHAPE PRESERVING APPROXIMATION WITH APPLICATION TO COMPUTER-AIDED GEOMETRIC DESIGN
D.F. McAllister, University of North Carolina, North Carolina State University, School of Physical & Mathematical Sciences, Dept. of Computer Science, *Raleigh, North Carolina* 27607 (NAG 1-103)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

7.0004, COMPUTER PROGRAM TO MINIMIZE THREE-DIMENSIONAL FLIGHT TIME TRACKS
F.I. Parke, Case Western Reserve University, School of Engineering, Dept. of Systems Engin Computer Engin & Information Sciences, *University Cir., Cleveland, Ohio* 44106 (NAG 3-101)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lewis Research Center

7.0005, OPERATION OF A NASA INDUSTRIAL APPLICATION CENTER (IAC)
J.H. Thompson, University of Pittsburgh, School of Arts & Sciences, Dept. of Computer Science, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (NASW 3403)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space & Terrestrial Applications

7.0006, IDENTIFICATION OF HEREDITARY CONTROL SYSTEMS VIA APPROXIMATION TECHNIQUES 15561-M
J.A. Burns, Virginia Polytechnic Inst. & State University, School of Arts & Sciences, Dept. of Mathematics, *Blacksburg, Virginia* 24061 (DA0F9224; DAAG29-78-G-0125)

To develop identification techniques and computational methods of parameter estimation for dynamical systems governed by functional differential equations. Relevance - the work may lead to efficient numerical techniques that could be profitably employed in such Army applications as control and stabilization studies (ARRADCOM-SCL), improved modeling of helicopter dynamics (AVRADCOM), and tactical missile system aerodynamics (MIRADCOM).

The research will be based on the state space formulation for hereditary control systems and approximation techniques for functional differential equations.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, EXPERIMENTAL RELATIVITY BY DAYTIME ASTROMETRY AT SCLERA
H.A. Hill, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (PHY80-08839)

Research in experimental gravitational physics initiated under grant AST79-08558 will be continued. Among the projects of interest are improved measurements of solar oblateness, and astrometric measurements of planetary motion to achieve higher accuracy determinations of the advance of perihelion and deflection of light predicted by Einstein. Improved limits will be set on possible slow variations of the universal constant of gravitation.

This is the first year of a two-year continuing grant, previously supported under NSF grant AST79-98558.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0002, EXCITATION OF ATOMIC OXYGEN BY LOW-ENERGY ELECTRON IMPACT
R.J. Anderson, University of Arkansas, Fayetteville Campus, School of Arts & Sciences, Dept. of Physics, *Fayetteville, Arkansas* 72701 (ATM79-18900)

This grant funds a research project that will carry out a comprehensive investigation of the excitation of atomic oxygen by low-energy (0-500 eV), electron impact. Measurements of the excitation cross-section will be obtained for the (ns) 3,5B, (np) 3,5P and (n' 3,5D) states of the OI spectrum with n equals 3,4,5, and n' equals 3,4. In addition, the variation of excitation cross-section as a function of incident electron energy, (optical excitation function), will be investigated and the asymptotic dependence of the cross-section will be compared to theoretical prediction.

The experiment will utilize a high-power vacuum-UV eximer laser to produce photodissociation of parent O2 molecules into the O(3P) and O(1D) states of atomic oxygen. Subsequent exctitation by a pulsed electron beam, of variable energy, will yield collisional radiation which will be detected using photon-counting techniques.

In addition to the specific research experiments described above, this research program will demonstrate the feasibility of combining laser photodissociation and electron excitation research techniques. Thus, it will open new avenues of investigation for scientists in atomic and atmospheric physics.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0003, HIGH ACCURACY HEAT CAPACITY MEASUREMENT THROUGH THE LAMBDA TRANSITION OF LIQUID HELIUM
W.M. Fairbanks, Stanford University, School of Humanities & Sciences, Dept. of Physics, *Stanford, California* 94305 (NAG 2-62)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0004, THEORETICAL STUDIES IN GRAVITATION AND ASTROPHYSICS
R.V. Wagoner, Stanford University, School of Humanities & Sciences, Dept. of Physics, *Stanford, California* 94305 (PHY79-20123)

Research in theoretical gravitation and astrophysics initiated under NSF grant PHY76-21454A02 will continue. Topics to be investigated include: A. Sources of Gravitational Radiation; B. Detectors of Gravitational Radiation; C. The Early Universe; D. Origin of Cosmic Inhomogeneities; E. Determining Ho and

qo from Supernovae; F. The Confrontation Between Gravitation Theory and Experiment; G. The Principle of Equivalence; H. The Binary Pulsar; I. The Relativistic Kepler Problem; J. Motion of Charged Particles in Curved Spacetime; K. Black Hole Accretion Disks; L. Cosmic Microwave and X-ray Backgrounds.

This is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0005, SIMULATION OF IONOSPHERIC EM-PLASMA INTERACTIONS IN A LARGE LABORATORY DEVICE

A.Y. Wong, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (DF044880; F49620-76-C-0011)

AF function - operation of high altitude vehicles in a post nuclear explosion environment, development of electromagnetic weapons, both laser and beam weapons, space and ionospheric communications and countermeasures demand design data which can only be obtained from fundamental understanding of high temperature high beta plasma. Deficiency - present day understanding of high temperature high-beta plasmas, e.g., waves and instabilities as well as localized phenomena cavitons and solitons is incapable to satisfy the aforementioned requirements. Objective - this research will develop suitable instrumentation such as microwave holography and microwave tomography to perform experiments on steady and unsteady plasmas at various conditions of density and temperature. Contribution - this work is a part of a comprehensive program of plasma research for the development of an X-ray radiation source for simulation of nuclear weapon effects, the development of advanced electromagnetic weapons (laser and ion beam), the development of space and ionospheric communications, and the development of countermeasures.

Previous work found that the linear conversion of EM waves to electrostatic waves produces a large amplitude electric field near the resonant location. The presence of this enhanced field leads to the nonlinear caviton state. Along with the development of this state, fast electrons and ions are observed on both sides of the resonant location. The foregoing will be expanded to the case when a magnetic field is superimposed on the plasma. They expect to examine the following three cases a. The ordinary mode b. The extraordinary mode and c. The electromagnetic mode. In addition they will study the space and time development of the evanescent electric field. Subsequently the characteristics of parametric instabilities in the ionosphere will be investigated and thus prove or disprove certain published theories specifically the one by Perkins (our co-P.I. at Princeton) that the electron plasma waves generated through parametric decay can only propagate in a small cone about the magnetic field.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0006, THERMODYNAMICS OF FREE ELECTRON LASERS

W.B. Colson, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Physics, *Santa Barbara, California* 93106 (NAG 2-48)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0007, THE PROPERTIES OF ZINC-DOPED GALLIUM-INDIUM-ARSENIDE-PHOSPHATE

R.E. Hayes, University of Colorado, Boulder Campus, School of Engineering & Applied Science, Dept. of Electrical Engineering, *1200 University Ave., Boulder, Colorado* 80302 (ECS79-11333)

This program is concerned with basic measurements of the physical and electrical behavior of dopants in quaternary materials. The atomic distribution coefficient, effective electrical activity, and diffusion coefficient of zinc in gallium-indium-arsenide-phosphide thin films is being investigated. Films of interest are grown by liquid phase epitaxial techniques. Radiotracer methods employing zinc 65, coupled with electrical capacitive and conductivity measurements on zinc-doped samples are used to determine dopant properties.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Engineering & Applied Science, Div. of Electrical Computer & Systems Engineering

8.0008, STUDY OF GEOPHYSICAL PLASMA WAVES (45-600 S) BY USING IMS MAGNETOMETER NETWORKS

V.L. Patel, University of Denver, School of Arts & Sciences, Dept. of Physics, *2115 S. University Blvd., Denver, Colorado* 80210 (ATM79-23582)

This grant supports a study of low frequency hydromagnetic waves in geophysical plasmas using International Magnetospheric Study (IMS) Magnetometer Networks. These networks provide uniform data from similar magnetometer experiments located near a particular longitude or latitude. The waves to be studied are geomagnetic pulsations (also known as micropulsations) with periods in range of 45-600 s. Wave information on power spectra, polarization, orientation of polarization ellipses will be obtained from the basic data available at all observatories and will be correlated with the magnetospheric data. The observational information on the waves will be interpreted by using theoretical models, and, in theoretical wave generation mechanisms that will be studied for the interpretation of observational results.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0009, HIGH PRESSURE ELASTIC PROPERTIES AND EQUATION OF STATE OF STISHOVITE

M.E. Striefler, University of Hartford, School of Arts & Sciences, Dept. of Physics, *200 Bloomfield Ave., West Hartford, Connecticut* 06117 (EAR79-26206)

This is a project to determine the pressure dependence of the single crystal elastic constants, of the P and S-wave velocities and of the equation of state of stishovite up to 1 Mbar from a lattice theoretical calculation based on a Shell model. The electronic polarizability of the oxygen ions is included in addition to the Coulomb interactions and short-range repulsive and angle-bending forces. The parameters of the model and their dependence on pressure will be determined from spectroscopic data on stishovite and from spectroscopic, elastic, dielectric, and optical data of the isostructural compounds GeO2 and SnO2. The results will be applied to investigate various compositional models of the earth derived by means of the seismic inversion process and are prerequisite for further work on earth-forming oxides.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Earth Sciences

8.0010, POSITRONIUM RESEARCH

V.W. Hughes, Yale University, School of Arts & Sciences, Dept. of Physics, *206 Elm, New Haven, Connecticut* 06520 (PHY78-15068 A01)

The proposed study to two-photon laser spectroscopy of positronium is an important step in a more complete understanding of this simplest of all atomic systems (a positron plus electron). The collaborative effort with the Stanford laser group (Hansch & Schawlow) represents an exciting application of high resolution laser spectroscopy to this unique system. A precision measurement of the 1S-2S interval is to be made. The Lamb Shift in the 1S state should be observable and thus provide an interesting test of quantum electrodynamics.

This is the second year of a 2-year continuing grant, currently supported under NSF grant PHY78-15068.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0011, THIN FILM LAYERED ELECTROLUMINESCENCE 16048-P

F.E. Williams, University of Delaware, School of Arts & Sciences, Dept. of Physics, *Newark, Delaware* 19711 (DA0G8990; DAAG29-79-G-0039)

To develop the understanding and the details of electroluminescent (EL) mechanism in multilayered structures which have been shown to have high efficiency. Relevance - the research is directly relevant to ongoing work at ERADCOM on EL display systems.

A coordinated, experimental and theoretical program is proposed to prepare and evaluate traditional and new EL multilayered materials systems. These multilayer structures will be studied using standard optical electrooptical and capacitance spectroscopy methods. Measurements of the efficiency of such structures will also be made, and the theory developed in order to understand the mechanism for the reported high efficiency EL layers.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0012, STATIC AND DYNAMIC STRUCTURE OF SIMPLE FLUIDS

J.W. Dufty, State University System of Florida, University of Florida, College of Liberal Arts & Sciences, Dept. of Physics, *208 Tigert Hall, Gainesville, Florida* 32601 (CHE79-20385)

This grant is in the Thermodynamics part of the Structural Chemistry and Thermodynamics Program. Professor Dufty will study theoretically the time-dependent properties of the simple fluids by evaluating various time correlations functions which describe the decay and propagation of fluctuations in the fluid. Such fluctuations are readily measured by light or neutron scattering and can be simulated on high speed computers. Except for gases at low densities or idealized cases such as hard sphere fluids, the dynamical structure of fluids is incompletely understood at a fundamental, theoretical level. The investigations to be undertaken will seek to describe the dynamical properties of simple gases, composed of molecules that interact via realistic forces, over a range of temperatures and densities. This work is a continuation of that previously supported by Foundation grant CHE 7822211.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

8.0013, COMSTAR SATELLITE K-BAND PROPAGATION EXPERIMENTS 15012-GS

S.C. Bloch, State University System of Florida, University of South Florida, School of Natural Sciences, Dept. of Physics, *4202 Fowler Ave., Tampa, Florida* 33620 (DA0F9094; DAAG29-77-G-0224)

To assess the intensity, duration and directional properties of rain effects on space-to-earth propagation in the 19 and 29 gHz bands. Relevance - all the military services are relying heavily on the expansion of satellites for communication, navigation and other sophisticated military applications, which require the higher microwave carrier frequencies of 19 and 29 gHz. The primary obstacle to the use of the 19 and 29 gHz bands is the attenuation produced by intense rainfall.

To obtain and interpret long term statistics on propagation path characteristics in intense rainfalls from a spatial diversity experiment using an array of three receiving ground stations augmented by rainfall measurements from rain gages and weather radar.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0014, ELECTRONIC STRUCTURE AND TRANSPORT PROPERTIES OF SEMICONDUCTING POLYMERS

A.B. Kunz, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Physics, *207 Engineering Hall, Urbana, Illinois* 61801 (DF056370; F49620-79-C-0215)

AF function - this proposed research primarily falls in the 7.4 research objectives which deal with the theoretical and experimental investigations of electronic, optical, acoustic, thermal, magnetic and conducting properties of materials to evolve new and improved device concepts. In particular, the theoretical investigations of excitonic superconductors which have high temperature transitions will lead to a quantum jump forward in the development of electronic devices. Deficiency - a wide range of basic research efforts that support the development of devices and device concepts are needed for the application of contemporary electronic electromagnetic technology in the operational Air Force. Most studies of superconductors have investigated low transition temperature systems. Objective - the major emphasis is to investigate the excitonic mechanism in the most likely systems to be useful to AF needs. The logical candidates would include the semiconducting polymers. Contribution - this research is a part of a comprehensive program in statistical mechanics to study phase transitions.

The main goal of this research is to produce a series of electronic band studies for silicon based polymers and if time permits carbon based polymers. These investigations will be studied to identify these polymers or classes of polymers most likely to favor the establishment of excitonic mechanism for superconductivity. Investigations of donor levels caused by replacing polymer subgroups with alternate ones and mechanisms of ionizing these donors into the conduction band will be done. The coupling of these donor electrons to the exciton field of the polymer is to be computed and estimates of possible superconducting transition temperatures obtained.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0015, A LIGHT-SCATTERING INVESTIGATION OF SUPERCOOLED LIQUIDS AND THE LIQUID-SOLID PHASE TRANSITION

C.M. Sorensen, Kansas State University, School of Arts & Sciences, Dept. of Physics, *Anderson Hall, Manhattan, Kansas* 66502 (CHE79-21063)

This grant is in the Structural Chemistry and Thermodynamics Program. Professor Sorensen will make light-scattering measurements using photon correlation spectroscopy to probe liquid to solid first order phase transitions. Both crystal and glass formation will be investigated and the relationship between them will be explored. A number of different systems will be studied. The experiments will focus on the behavior of liquids as they are supercooled to the limit of their stability against the formation of crystals or as they pass through the glass transition.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

8.0016, THEORETICAL STUDIES OF NONLINEAR PHENOMENA IN PLASMAS

C.S. Liu, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (DN775702; N00014-77-C-0590)

Investigate nonlinear phenomena in plasmas with particular emphasis on fundamental problems related to the generation of localized field entities called solitons. This work provides improved information needed for solution of the problems of nonlinear effects in plasma experimental test systems which relate to Navy applications such as directed energy and weapons simulation.

Study the analytic properties of nonlinear wave equations in inhomogeneous media. Perform a theoretical investigation on certain fundamental problems in nonlinear plasma physics related to the generation of solitons. Specifically, this includes a theoretical analysis of solitons and parametric instabilities in inhomogeneous, magnetized plasmas and their role in plasma turbulence and particle acceleration.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0017, INVESTIGATION OF NOISE IN SOLIDS AT LOW TEMPERATURES
J. Weber, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics, *College Park, Maryland* 20742 (DF048190; F49620-77-C-0065)

AF function - gravity gradiometers are being developed to conduct gravity surveys over unmapped ocean areas to determine more precisely the deflection of the vertical along missile flight paths. Deficiency -the missile CEP requirements for the period 1990 are such that the gravity gradiometers will have to have an accuracy of ten to the minus 12th power g/m. Although the present technology of electronic components has reduced the thermal noise levels within the system to their equivalent Brownian motion, cryogenics techniques will have to be investigated to make any significant reduction in noise levels to meet the required specifications for future gravity gradiometers. Objective - this research will establish the procedures and cryogenic techniques required to operate future extremely sensitive instrumentation in a controlled environment. Contribution - inertial navigators are ultimately limited in accuracy by the determining of the local gravity field (deflection of vertical). Therefore, improved gravity gradiometers will provide the necessary data to determine the deflection of vertical during flight paths or operation.

Different materials will be selected to study the noise and attenuation factors at liquid nitrogen temperature (4.2 degrees Kelvin). These materials and cryogenic techniques will be investigated to determine their applications for use in gravity gradiometers. The third law of thermodynamics implies that the internal structure will become infinitely stable and the fluctuations quantum limited at sufficiently low temperatures. An objective of the present investigation is to assess how close to the limiting values can be achieved near 4 degrees k. By going to low temperatures, and further development of the present techniques of mounting, surface preparation, isolation and electronics instrumentation, it is hoped to observe the limiting noise in nearly perfect crystals. Material to be investigated will include aluminum, sapphire and niobium.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0018, ATOMIC PHYSICS EXPERIMENTS USING FAST ATOMIC BEAMS
F.M. Pipkin, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Physics, *Cambridge Station, Cambridge, Massachusetts* 02138 (PHY78-09657)

Fast atomic beams will be used in conjunction with laser and radiofrequency spectroscopy techniques to make precision measurements of the fine and hyperfine structure of the excited states of hydrogen-like atoms, to study charge exchange collisions, to measure the fine structure in the excited states of complex atoms and to measure the lifetimes of atomic states.

This work is a continuation of that currently supported by NSF Grant PHY76-14857 A02.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0019, MICROWAVE HEATING OF SUPERCOOLED WATER DROPLETS
W.M. Hollister, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 1-100)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0020, INVESTIGATION OF TOPICS IN OPTICAL ELECTRONICS AND GENERATION OF FAR-IR RADIATION 16225-P
A. Javan, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DA0G9032; DAAG29-79-C-0028)

(1) To study the fundamental physics of high speed metal-barrier-metal junctions and their application to optical electronics. (2) To search for novel approaches and perform experiments that will lead to generation of intense coherent radiation in the FIR and millimeter wave regions. Relevance - tunneling junctions are of fundamental importance to the detection and production of electromagnetic radiation. This directly impacts Army systems in the MW, FIR, and IR spectral regions. The fabrication techniques raise the possibility of the manufacture of sophisticated IR systems at low cost. The FIR generation work bears directly on the Army's NMMW thrust.

To deposit junctions of very small size and controlled barrier thickness in the visible, IR, FIR, MW, and RF spectral regions in order to observe their response as a function of applied bias. The ultimate goal is to extend microelectronic techniques into the optical spectral region. For the production of FIR radiation, they will consider rotational nonequilibrium, low lying vibrational states, excitation by slow electrons and impurity levels in semiconductors.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0021, HIGHLY EXCITED ATOMS
D. Kleppner, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF034500; F44620-72-C-0057)

AF function - this research effort is concerned with the investigation of very high lying atomic levels. These states of are great interest because of their large polarizabilities and stark shifts, low ionization potentials and large dimensions. This study of highly excited atoms can lead to new techniques for detecting millimeter and infrared radiation for application to communications and plasma diagnostics for example. Opportunity - this study of single highly excited atomic states presents opportunities for studying a variety of phenomena involving atoms and radiation, including photoionization processes, tunneling phenomena in static and oscillating fields, and resonance phenomena. It also permits the study of collision in highly excited species and of level crossing dynamics which are important in many inelastic atomic and molecular collisions. Objective - the goal of this effort is to complete the study of field ionization in alkali one-electron systems, and to investigate field ionization in hydrogen. Contribution - work on highly excited atoms is a very active field. The process of tunneling in an electric field of a one-electron atom has been observed in detail and the measured rates were found to be in serious disagreement with hydrogenic theory. The continuing effort will investigate tunneling in alkalies, particularly on effects of level mixing. Other work will include experiments on the Landau-Zever effect, and the creation of Rydberg states of hydrogen, and a theoretical study of tunneling in alkalies.

An experimental program will be established to investigate the following: (1) A single spot in a laminar flow where the production of turbulent energy will be examined and surface pressure variations measured as the spot passes. (2) Interaction between spots which are identical but displaced laterally, are behind one another, or any combination of above including different size. (3) The shape and structure of a spot in a turbulent boundary layer.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0022, DROP DYNAMICS AND BREAKUP
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SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0023, ANGULAR RESOLVED ELECTRON EMISSION STUDIES OF MICROWAVE MATERIALS
G.J. Lapeyre, Montana State University, School of Letters & Sciences, Dept. of Physics, *Bozeman, Montana* 59715 (DF041290; F49620-77-C-0125)

AF function - modern aerospace electronic systems depend heavily upon solid state electronic and optical devices. Opportu-

nity - future improvement in performance of these devices requires a thorough understanding of the electronic structure and excitation processes in selected solids. Present solid state electronic and optical devices are based upon the properties of a relatively small percentage of the total number of materials potentially available. Objective - the objective of this research program is to provide knowledge on the electronic structure, electronic transitions and interaction, and optical properties for both the bulk and surface states of materials currently under investigation for microwave devices. How work contributes-it is anticipated that this research will provide knowledge which could lead to improvement in solid state devices that depend on surface effects such as the behavior of junctions and vapor films.

This research program experimentally investigates bulk and surface electronic and optical properties of iii-v semiconductors, and single crystal metals using angular resolved, polarization dependent and other innovative photoemission techniques in the 2 to 125 ev photon range, auger electron spectroscopy, low energy diffraction and energy band analysis. Angle-resolved measurements are used to obtain information on the momenta as well as the energies of the bands in crystalline materials. The linear polarization of the synchrotron radiation will be used to infer symmetry properties of band states and localized states and make it possible to exploit selection rules based on the symmetries.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0024, ELECTRONS IN COMPLEX SOLIDS
D.J. Sellmyer, University of Nebraska, Lincoln Campus, School of Arts & Sciences, Dept. of Physics, *Lincoln, Nebraska* 68508 (DMR78-10781)

The object of this research is the investigation of electronic and magnetic states in relatively complex solids. These materials either exhibit new types of physical phenomena or require new theoretical models for their understanding. Several classes of problems will be studied: (1) electronic structure of d and f band metallic compounds, (2) electronic and magnetic states in limited dimensionality conductors, and (3) electronic and magnetic states in metallic glasses.

The experimental work will consist of high-field magnetoresistance and quantum oscillatory measurements in fields up to 220 KOe. In systems where electronically driven or magnetic phase transitions are involved, electron transport, magnetic susceptibility, and high-field magnetization measurements will be performed.

The results should contribute to our understanding of (1) the relationship between electronic structure and magnetic, structural, and superconducting phase transitions, (2) the relationship between electronic structure and chemical bonding in structures where the bonding is poorly understood, (3) the localized-moment and itinerant-electron aspects of magnetism in conducting solids, (4) the electronic structure and electron-transport properties of intertransition-metal amorphous alloys, and (5) the dependence of the magnetic properties of glassy metals on fluctuations of exchange constants, local random anisotropy, charge transfer, and structural effects.

This research was previously supported under DMR-7617417. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0025, OPTICS OF SOLIDS (SURFACE-RELATED) AND EFFECT OF SURFACE ROUGHNESS OF MOS 16180-P
J.L. Birman, City University of New York, City College, School of Liberal Arts & Sciences, Dept. of Mathematics, *Convent Ave. & 138th St., New York, New York* 10031 (DA0G8958; DAAG29-79-G-0040)

To study optics of bounded gyrotropic media and the effect of interface roughness on conductivity in metal oxide-semiconductor structures. Relevance - the research is relevant to (1) work on metal oxide-semiconductor devices at ERADCOM, (2) understanding and improving the gyrotropic effect of the materials used in Pockels readout optical modulator devices, (3) to possibly extremely fast response characteristics of 'enhanced photoemission' devices that use surface mode excitation.

Using a time-dependent formulation of the extinction theorem, attenuated total reflection and total internal reflection will be studied in a transient mode of excitation of surface modes. Using an inverse dielectric function formulation which includes spatially dispersive effects, the possible existence of increased gyrotropy (optical rotatory power) will be investigated. For the study of metal oxide-semiconductor systems, the 'method of perturbed boundary conditions' will be used to include the effect of surface roughness from the very beginning on the wave functions, the energy levels and the mobility.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0026, WEAPONRY - ATOMIC STRUCTURE AND ATOMIC PROCESSES IN INTENSE LASER FIELDS
M.H. Mittleman, City University of New York, City College, School of Liberal Arts & Sciences, Dept. of Physics, *Convent Ave. & 138th St., New York, New York* 10031 (DN223480; N00014-76-C-0014)

The objective is to investigate the effects of laser radiation on atomic and molecular processes. These effects can be important in scaling of laser systems or transmission of high intensity laser beams and thus are of interest to the Navy's weapons systems. They are also important to the Navy with regard to their application to isotope separation for naval reactors.

The contractor is studying electron-atom scattering in a low frequency laser field taking into account the atomic structure. He is also studying the use of statistical methods to treat double ionization.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0027, THEORY OF CHARGE TRANSFER AT SEMICONDUCTOR-ELECTROLYTE INTERFACES
D. Mattis, Polytechnic Inst. of New York, Brooklyn Campus, School of Arts & Sciences, Dept. of Physics, *333 Jay St., Brooklyn, New York* 11201 (DN875508; N00014-78-C-0594)

Electrochemical processes at the semiconductor-electrolyte interface are important in many Navy areas of interest, including photolysis of water, photovoltaic devices, corrosion and techniques for surface passivation of semiconductors. Improved devices and better control of many problems associated with electrochemical processes of surfaces will result from better understanding of the mechanisms associated with charge transfer and current flow at these interfaces.

The investigator is developing theoretical techniques to describe the charge exchange between semiconductor surfaces and adsorbed atoms. These will be applied to the charge transfer process occuring at the interface between a semiconductor and a liquid electrolyte while under illumination. Electronic eigenstates will be determined as will normal vibrational modes of the adatom. Other areas of application will be the interface between oxides and silicon and the compound semiconductors. Defect levels and resonant levels for tunneling mechanisms will be considered. Particular attention will be directed to the breakup of excitons impinging on the interface and its electron-ion analog in the photoelectrochemical cell problem.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0028, COHERENCE THEORY WITH SPECIAL REFERENCE TO ENERGY TRANSFER BY ELECTROMAGNETIC RADIATION 14074-P
E. Wolf, University of Rochester, School of Arts & Sciences, Dept. of Physics & Astronomy, *260 Crittenden Blvd., Rochester, New York* 14627 (DA0E9255; DAAG29 77 G0006)

To develop the theory of propagation of coherent electromagnetic radiation through atmospheric media. Relevance - the proposed work is relevant to problems of discrimination in laser radar applications directly related to Electronic Warfare Labs's optical programs and to MICOM's radar programs.

The approach will unify the theory of radiometry, the theory of heat radiation and the theory of radiative transfer at fundamental classical and quantum levels.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0029, SUPERFLUID TURBULENCE

J.T. Tough, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Physics, *164 W. 17th Ave., Columbus, Ohio* 43210 (DMR79-25089)

Research supported under DMR-7708601 will be continued and extended. An experimental program consisting of five sets of experiments will considerably expand our fundamental understanding of superfluid turbulence. One of these sets involves the use of a recently developed technique for measuring very small temperature differences to study geometrical effects on superfluid turbulence; this work will test our understanding of superfluid turbulence in large tubes. A parallel series of experiments will study counterflow in tubes where the normal fluid is stationary. Development of a new nonperturbative local probe of superfluid turbulence to yield new information on size effects and homogeneity will be undertaken. These experiments, as well as the thermal counterflow experiments, will have sufficient sensitivity to permit a study of fluctuation phenomena in the turbulence.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0030, PHYSICS QUARTZ PROCESSING

J.J. Martin, Oklahoma State University, School of Arts & Sciences, Dept. of Physics, *Agricultural Hall, Stillwater, Oklahoma* 74075 (DF903320; F19628-77-C-0171)

The objective of this effort is to develop superior material for timing applications. How research contributes - development of new hardening techniques for quartz may result in superior quartz resonators. The Air Force function is navigation, communication, surveillance. Deficiency - presently available resonator materials suffer long term frequency instability and radiation damage.

The approach will be a study of the defects produced by various types of radiation and develop methods to overcome defect formation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

8.0031, ELECTRONIC PROPERTIES OF CARBON FIBERS

J.W. McClure, Oregon State Higher Education System, University of Oregon, School of Arts & Sciences, Dept. of Physics, *Johnson Hall, Eugene, Oregon* 97403 (DMR79-21545)

The electronic properties of carbon fibers will be investigated by calculating several properties for a promising model of the microstructure: long, monolayer ribbons of graphite which may be wrinkled. The disperson relations of the current carriers have been worked out by the 'Linear Combination of Atomic Orbitals' (LCAO) method. Calculations of the diamagnetism, which supported the wrinkled sheet model and gave an estimate of 340 Angstroms for the widths of the ribbons, will be continued. New calculations will be performed of the g-shift in the electron spin resonance, electrical resistivity (including its temperature dependence), thermoelectric power, piezoresistance, and magnetoresistance. In the first phase of the work, the effects of localized defects will be treated by altering the Fermi level and using scattering models. In the second phase, the localized defect potential will be included and the scattering and carrier densities calculated directly. Comparison of the results with experiment should aid in determining the microstructure of carbon fibers and should also improve our general understanding of the electronic structure of carbons and its evolution during graphitization.

This is a renewal of NSF Grant DMR78-09047, and is the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0032, ELECTRONIC AND OPTICAL PROPERTIES OF ONE-DIMENSIONAL CONDUCTORS 14584-P

A.J. Heeger, University of Pennsylvania, School of Arts & Sciences, Dept. of Physics, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (DA0F8946; DAAG29 77 G0089)

To determine the role of defects in controlling the physical properties of low dimensionality materials including polymeric metals. Relevance - the polymeric sulfur nitrides are extremely important because of their unique conducting properties as well as their energetic properties. This class of materials holds a potential for application to fuze and ignitor train technology.

Defects will be introduced in a controlled way using existing accelerator facilities. Measurements will be made on samples so produced including DC electrical conductivity, microwave conductivity, dielectric constant, magnetic and optical properties. Materials to be studied include TTF-TCNQ and (Sn) sub x.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0033, ATOMIC COLLISIONS AND PLASMA PHYSICS 17140-P

M.A. Biondi, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics & Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (DA0G1789; DAAG29-80-C-0075)

To provide experimentally obtained data and a basic understanding of atomic collision processes involving electrons, ions and neutral molecules which play significant roles in determining the response of the atmosphere to energy inputs. Relevance - this work supports the DNA atmospheric modelling code program. It also provides needed data for the low-level atmospheric modelling effort at atmospheric sciences laboratory.

The program will be based chiefly on laboratory measurements centered around the use of multi-mode microwave afterglow apparatus and drift-mobility tubes. Some effort will be aimed at comparing the experimental results with results obtained from analysis of the Atmosphere Explorer measurements. The topics to be investigated include the measurement of: 1. Effects of electronic and vibrational excitation on reaction rates for atmospheric reactions such as oxygen with nitrogen and excited oxygen ions with oxygen molecules. 2. The formation and disassociation rates for weakly bound clusters involving both atmospheric and metal ions. 3. Electron recombination rates for atmospheric ion clusters. 4. Ion-ion recombination rates for atmospheric ions.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

8.0034, RESEARCH IN GAS LASERS

T.F. Morse, Brown University, Graduate School, Dept. of Engineering, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DF038310; AFOSR-79-0052)

AF function - weaponry. Opportunity - kinetic theory and fluid mechanical knowledge are continuing to improve the basic understanding of gas lasers. This principal investigator distinguished himself during the former AFOSR rarefied gas dynamics program, and under the present grant he has made significant contributions to the technical literature of gas laser kinetics. Several aspects of the fluid mechanics and kinetics of gas lasers still require clarification to facilitate improved design capabilities. Objective - to apply previously developed velocity dependent rate equations for nonlinear radiative effects to optical pumping by gas lasers. How work contributes - this work will apply a previous treatment of the interaction of two radiation fields with three-level atoms to some important problems occurring in molecular gas flow lasers.

Theoretical work will deal with the kinetics of optical pumping, considering nonlinear radiative effects and arbitrary

spectral broadening, along with rotational and vibrational relaxation, and development of the equations useful in nonlinear di-, agnostic techniques. Small scale experimental efforts to investigate the plasma velocimeter will be extended.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0035, ATOM-ATOM SCATTERING CROSS-SECTIONS
J.C. Browne, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Computer Sciences, *200 W. 21st St., Austin, Texas* 78712 (DN223160; N00014-75-C-0498)

Relativistic interactions play an important role under several circumstances. The purpose of this contract is to study via ab initio calculations mechanisms involving these interactions. In addition, the interaction of atoms and molecules with intense electric fields is being studied. These are important in the naval areas of gaseous electronics, lasers, and laser propagation.

Relativistic effects on atomic collisions are being studied with emphasis presently on He-He (plus 2) collisions. Charge transfer cross sections for collisions of H with C(plus 5), C(plus 6), N(plus 5), and O(plus 6) are being studied. Computations of the spectra of molecules in intense electric fields are being performed for H(2).

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0036, SUPERCONDUCTIVITY IN METAL-HYDROGEN SYSTEMS
C.B. Satterthwaite, Virginia Commonwealth University, School of Arts & Sciences, Dept. of Physics, *901 W. Franklin St., Richmond, Virginia* 23284 (DMR80-09303)

The study of the superconducting properties and related normal state properties of metal-hydrogen compositions conducted under grant number DMR-7708463 will be continued. There are two aspects to this research: (1) a study of the electronic contribution to the specific heat in PdHx and PdDx to determine to what extent the electronic properties of the two isotopic compounds differ, and (2) further study of the order-disorder transformations in the N(D) sublattice of PdH(D)x and its effect on the temperature and breadth of the superconducting transition. In parallel with these studies a program will be undertaken to improve methods of preparation of metal-hydrogen compositions.

This is a continuation of work supported at the University of Illinois under NSF grant number DMR-7708463.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, SOCIOLOGICAL SURVEY IN RELATION TO PROJECT ON ADVANCED TECHNOLOGY DISPLAY HOUSE (ATDM)
E. Huttman, California State University & Colleges, California State University, Hayward Campus, School of Arts Letters & Social Sciences, Dept. of Sociology, *25800 Carlos Bee Blvd., Hayward, California* 94542 (NCA 2-290101)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, THE RADIAL VELOCITY SEARCH FOR EXTRASOLAR PLANETS
K.M. Serkowski, University of Arizona, Lunar & Planetary Lab., *Tucson, Arizona* 85721 (NAG 2-52)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

10.0002, THE STUDY OF STAR FORMATION AND MOLECULAR CLOUD EVOLUTION WITH THE KUIPER AIRBORNE OBSERVATORY
H. Thronson, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (NAG 2-55)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

10.0003, OBSERVATIONAL STUDIES OF EXTRAGALACTIC OBJECTS
M.A. Aaronson, University of Arizona, Steward Observatory, *Tucson, Arizona* 85721 (AST79-21663)

Observational extragalactic research to be conducted in several areas over the next two years will be carried out. First, a major new program for measuring the distance scale and the expansion rate of the universe, and for determining the noise and possible anisotropy in the Hubble flow will be determined. The method to be employed exploits the relation between galaxian infrared luminosity and neutral hydrogen (HI) velocity profile width. Among methods based on global properties, this technique is probably now the most accurate tool available for determining redshift-independent distances to galaxies. Second, an already ongoing program relating primarily to the stellar content of galaxies in the red and near-infrared is described. The overall goals of this program are to study the stellar population, star formation rate, metal abundance, and incidence of infrared excess in galaxies having a wide range of morphological type and absolute magnitude. The third program to be pursued will be a spectrophotometric survey of quasistellar objects in the 1-4 micron region, the results of which should enable much stronger constraints to be placed on theoretical quasar models. This study will utilize the Multiple Mirror Telescope, which is the largest instrument in the world designed for ground-based infrared observations.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0004, LONG TERM X-RAY OBSERVATIONS OF SYSTEMS WITH UNUSUAL OPTICAL COUNTERPARTS
C.S. Bowyer, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NAG 5-117)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0005, ULTRAVIOLET STUDY OF HOT STARS ASSOCIATED WITH RING-NEBULAE
Y.H. Chu, University of California, Berkeley Campus, School of Letters & Science, Dept. of Astronomy, *Berkeley, California* 94720 (NAG 5-103)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0006, OBSERVATIONS OF INTERSTELLAR CLOUD DENSITIES AND DETECTION OF INTERSTELLAR NEUTRAL CLORINE
M.A. Jura, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Astronomy, *405 Hilgard Ave., Los Angeles, California* 90024 (NAG 5-116)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0007, OBSERVATIONS OF SELECTED ASTRONOMICAL EMISSION LINES
M.J. Plavec, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Astronomy, *405 Hilgard Ave., Los Angeles, California* 90024 (NAG 5-112)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0008, INTERSTELLAR OBSERVATIONS OF OB ASSOCIATIONS WITH THE COPERNICUS SATELLITE
J.M. Shull, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Astro Geophysics, *1200 University Ave., Boulder, Colorado* 80302 (NAG 5-111)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0009, OBSERVATION OF THE LYMAN ALPHA LINE DURING PRIMARY ECLIPSE OF BETA PERSIEDS
F.B. Wood, State University System of Florida, University of Florida, College of Liberal Arts & Sciences, Dept. of Astronomy & Physics, *208 Tigert Hall, Gainesville, Florida* 32601 (NAG 5-110)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0010, SUBMILLIMETER OBSERVATIONS OF SOLAR LIMB BRIGHTENING IN THE SOLAR ECLIPSE OF 31 JULY 1981
E. Becklin, University of Hawaii System, Manoa Campus, Inst. for Astronomy, *2840 Kolowala St., Honolulu, Hawaii* 96822 (NAG 2-59)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

10.0011, OBSERVATIONS OF DISTANT STELLAR SYSTEMS
R.G. Kron, University of Chicago, School of Physical Sciences, Dept. of Astronomy & Astrophysics, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (AST79-20994)

A study of the energy received from very distant galaxies will be carried out in order to investigate evolutionary changes. The principal concept is the connection between 'look-back time' and distance, due to the finite speed of light. Thus distant galaxies are seen at an earlier stage than nearby galaxies, and are expected to display signs of relative youth in their proportions of different types of stars, which can in turn be deciphered from their spectra. This goal is to be achieved by measuring the relative amounts of energy from faint galaxies received at different wavelengths, ranging from the blue optical band to the far red optical band to the radio band. The distances, and hence look-back times, are to be obtained by measuring the red shifts of selected galaxies. Because distant galaxies are so faint, previous work designed to study the expected evolution of galaxy light has been largely inconclusive. Modern techniques to be used here hold great promise of collecting sufficient information to allow theoretical models for the evolution of galaxy light to be tested. All lines of reasoning based on other arguments indicate that galaxies should look different in the distant past; verifying that such is really the case would be an important contribution to the general picture of galaxies and the universe.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0012, RECONNAISSANCE AND RECOVERY OF THE BRIGHTER ASTEROIDS
F.K. Edmondson, Indiana University, Bloomington Campus, School of Arts & Sciences, Dept. of Astronomy, *Memorial Hall, Bloomington, Indiana* 47401 (NAGW 98)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Space Science

10.0013, INVESTIGATIONS OF ACTIVE GALACTIC NUCLEI
A.S. Wilson, University of Maryland, College Park Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *College Park, Maryland* 20742 (AST79-24381)

Two aspects of the energy output in galaxies will be investigated by means of radio continuum and optical spectroscopic observations. First, radio continuum observations of Seyfert and sharp emission line galaxies will be continued and extended. A survey of all Seyfert galaxies at accessible declinations will shortly be completed at the Westerbork telescope in the Netherlands to a limit of about 3 mJy at 1.4 gHz. Current observations with the Very Large Array (VLA) will be continued to determine the spatial extent of the radio emission and its correlation with other properties. Theoretical studies of the acceleration of the cosmic rays in the forbidden line region and their relation to the thermal gas will be initiated. Second, the dynamical properties of elliptical and radio galaxies with emission lines and Seyfert galaxies will be studied by means of long slit optical spectroscopy. Such work is important not only for the understanding of the motion of gas in the central regions of ellipticals and the origin of the powerful double radio sources, but also to determine the structure of the shocks which probably accelerate the relativistic electrons responsible for the radio emissions.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0014, A LONG BASELINE STELLAR INTERFEROMETER FOR ASTRONOMY
D.H. Stalein, Massachusetts Inst. of Technology, School of Science, Dept. of Earth & Planetary Sciences, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NAG 2-50)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

10.0015, DOPPLER LINE PROFILE MEASUREMENT OF THE JOVIAN LYMAN ALPHA EMISSION
S.K. Atreya, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Atmospheric & Oceanic Science, *Ann Arbor, Michigan* 48104 (NAG 5-109)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0016, SEARCH FOR INTERSTELLAR WATER ABSORPTION
W.H. Smith, Washington University, School of Arts & Sciences, Dept. of Chemistry/Earth Planetary Sciences, *4559 Scott Ave., St. Louis, Missouri* 63130 (NAG 5-108)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0017, SIMULTANEOUS IN-ECLIPSE ULTRAVIOLET OBSERVATIONS OF EARLY-TYPE ECLIPSING
D.D. Meisel, State University of New York, College at Geneseo, School of Arts & Sciences, Dept. of Physics & Astronomy, *Geneseo, New York* 14454 (NAG 5-113)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0018, GALACTIC AND EXTRAGALACTIC RESEARCH WITH THE RELOCATED BURRELL SCHMIDT
P. Pesch, Case Western Reserve University, Graduate School, Dept. of Astronomy, *2040 Adelbert Rd., Cleveland, Ohio* 44106 (AST79-21572)

Three large-scale objective-prism surveys, utilizing different dispersions and spectral regions, and designed for the discovery and study of a variety of stars within our galaxy and extragalactic objects, are described. These surveys utilize the largest Schmidt telescope with objective prisms in the United States. This telescope, the Burrell Schmidt, has recently undergone major improvements and has just been moved to a superior ob-

serving site on Kitt Peak in Arizona. One survey utilizes a 10 degree objective-prism combination for relatively high-dispersion spectra in the blue region and will cover the entire sky north of approximately delta equals plus 10 degrees. The goals of this survey are: 1) early discovery of peculiar and other stars of special interest; and 2) at a later time, the systematic reclassification on the MK system of all the brighter (specifically, the Henry Draper Catalogue) stars contained on the plates. Another survey utilizes a 4 degree objective-prism for relatively low-dispersion spectra in the yellow-red region and will cover the northern sky (exclusive of the Milky Way). The purpose of this survey is to identify carbon and S stars, emission-line (Halpha, (OIII) 4959 & 5007) objects, late M giants and dwarf M and late K stars down to limiting visual magnitude of about 12.5. A third survey will cover the northern sky (exclusive of the Milky Way) at low dispersion over a broad spectral range. This survey is designed specifically to discover emission-line quasistellar objects and galaxies. All of these three surveys are particularly important in that they complement similar surveys in the southern hemisphere.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0019, A SURVEY OF NEARBY STARS FOR THE PERTURBATIVE EFFECTS OF EXTRASOLAR PLANETARY SYSTEMS

G.D. Gatewood, University of Pittsburgh, School of Arts & Sciences, Dept. of Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (NAG 2-53)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

10.0020, A BI-DIMENSIONAL, CENTER-OF-THE-DISK ANALYSIS OF RESIDUAL-INTENSITY FLUCTUATIONS IN A SOLAR SPECTRUM LINE

F.N. Edmonds, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST79-08551)

It is proposed to complete a study of the one and bi-dimensional power, coherence and phase spectral analyses of line-formation fluctuations in the solar NaI D1 line. The goal is a better understanding of how inhomogeneities affect the structure of the photosphere and the analysis of spectral lines for the Sun and stars. Such an understanding should help in overcoming some of the most important obstacles to significant improvement in accuracy and reliability of quantitative spectral-line analyses. Also, it should provide badly needed guidelines for the construction of more realistic model stellar atmospheres.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

GENERAL

11.0001, FIRST-PHASE RESEARCH AND CONCEPTUAL ANALYSIS FOR COMMERCIALIZATION OF REDOX ENERGY STORAGE AND PHOSPHORIC ACID FUEL CELL SYSTEM

L.A. Sullivan, University of California, Berkeley Campus, Graduate School, *2200 University Ave., Berkeley, California* 94720 (NAG 3-111)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Lewis Research Center

11.0002, OBSERVATION AND THEORY IN THE DEVELOPMENT OF ASTRONOMY

B.R. Goldstein, University of Pittsburgh, School of Arts & Sciences, Dept. of History & Philosophy of Science, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (SOC77-23594 A01)

Dr. Goldstein is collecting and analyzing reports of medieval observations of the planets, the moon, and eclipses that survive in Hebrew and Arabic manuscripts for the elucidation of medieval observational techniques and for their potential use by modern astronomers. A search of these manuscripts for additional data on total solar eclipses and other celestial phenomena is also being undertaken.

This research will help to clarify the relationship between theory and observation as well as the way in which instruments were modified on the basis of observational experience in the history of astronomy. Furthermore, the historical records, particularly of eclipses, will help contemporary astronomers in their study of the secular acceleration of the earth and the moon.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Biological Behavioral &
Social Sciences, Div. of Social &
Economic Science

11.0003, LECTURE SERIES ENTITLED OUR FUTURE IN THE COSMOS

C.H. Barnes, College of William & Mary, Williamsburg College, Graduate School, *Ewell Hall, Williamsburg, Virginia* 23185 (NAS 1-16375)

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N81-13016# Federal Aviation Administration, Washington, D.C. Office of Aviation Policy.
FAA AVIATION FORECASTS, FISCAL YEARS 1981 - 1992
Sep. 1980 69 p
(AD-A091288; FAA-AVP-80-8) Avail: NTIS
HC A04/MF A01 CSCL 01/2

The aviation activity at FAA towered airports, in the aerospace under the control of the Air Route Traffic Control Centers, and the services provided by the Flight Service Stations *are forecast* for the several user groups: trunk and local service airlines, commuter airlines and air taxis, general aviation, and the military. *Discussion of trends and events with special implications for* aviation highlight the challenges and opportunities that lie ahead for aviation. Also presented are forecasts based on three alternative scenarios: economic expansion, energy conservation and stagflation. The alternative scenario forecasts provide a range *around the baseline forecasts for planning purposes both within* the FAA as well as for other users of the FAA forecasts. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N81-13017 Georgia Inst. of Tech., Atlanta.
NUMERICAL STUDY OF SEPARATED TURBULENT FLOW OVER AIRFOILS Ph.D. Thesis
Ananthanarayanan Sugavanam 1979 141 p
Avail: Univ. Microfilms Order No. 8028450

A numerical scheme for the solution of two dimensional *turbulent incompressible time-dependent Reynolds equations* was developed and is presented, with special emphasis on flow past airfoils. This scheme utilizes the mean flow vorticity and the *mean flow velocities as the dependent variables.* The airfoil was mapped conformally into a circular cylinder and the equations *were solved numerically in the cylinder plane. The accuracy and* versatility of this computational procedure developed was demonstrated by solving several laminar and turbulent flow problems with simpler geometries and comparing the results obtained with the available experimental data for these cases. These examples included a turbulent couette flow, turbulent flow past a finite flat plate with and without oscillations along its own length, laminar and turbulent flows past a circular cylinder and turbulent flow past a 12% thick Joukowski airfoil at zero angle of attack. Dissert. Abstr.

N81-13018*# National Aeronautics and Space Administration, Washington, D. C.
UNSTEADY EFFECTS OF A CONTROL SURFACE IN TWO DIMENSIONAL SUBSONIC AND TRANSONIC FLOW
R. Grenon (ONERA), A. Desopper (ONERA), and J. Sides (ONERA)
Jun. 1980 45 p refs Transl. into ENGLISH of "Effects Instationaires d'une Governe en Ecoulement Bidimensionnel Subsonique et Transonique" Rept. AGARD-CP-262 *Transl.* by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75775; AGARD-CP-262) Avail: *NTIS*
HC A03/MF A01 CSCL 01A

The experimental results of steady and unsteady pressure *measurements, carried out in subsonic and transonic flow on a* 16 percent relative thickness supercritical aerofoil, equipped with *a trailing edge flap involving 25 percent of the chord, in a* sinusoidal motion are given. These experimental results are compared with those obtained by various methods of steady *and unsteady inviscid flow calculations. Some calculation results* in which viscous effects have been taken into account, for both steady and unsteady flows, are also presented. M.G.

N81-13019*# *National Aeronautics and Space Administration.* Lewis Research Center, Cleveland, Ohio.
NASA CONTRIBUTIONS TO RADIAL TURBINE AERODYNAMIC ANALYSES
Arthur J. Glassman 1980 20 p refs Presented at Automotive *Technol. Develop. Contractor Coord. Meeting, Dearborn, Mich.,* 11-13 Nov. 1980
(NASA-TM-81644; E-9356-1) Avail: NTIS HC A02/MF A01 *CSCL 01A*

A brief description of the radial turbine and its analysis needs is followed by discussions of five analytical areas: design geometry *and performance, off design performance, blade row flow, scroll* flow, and duct flow. The functions of the programs, areas of applicability, and limitations and uncertainties are emphasized. Both past contributions and current activities are discussed.
Author

N81-13020*# Analytical Methods, Inc., Bellevue, Wash.
CALCULATION OF TWO DIMENSIONAL VORTEX/SURFACE INTERFERENCE USING PANEL METHODS Final Report
B. Maskew Dec. 1980 90 p refs
(Contract NAS1-15495)
(NASA-CR-159334; Rept-79-13) Avail: *NTIS*
HC A05/MF A01 CSCL 01A

The application of panel methods to the calculation of vortex/surface interference characteristics in two dimensional flow was studied over a range of situations starting with the simple case of a vortex above a plane and proceeding to the case of vortex separation from a prescribed point on a thick section. Low order and high order panel methods were examined, but the main factor influencing the accuracy of the solution was the distance between control stations in relation to the height of the vortex above the surface. Improvements over the basic solutions were demonstrated using a technique based on subpanels and an applied doublet distribution. Author

N81-13021# Cambridge Univ. (England). Dept. of Engineering.

FORCE AND MOMENT COEFFICIENTS FOR HIGH DEFLECTION CASCADES

D. S. Whitehead and R. J. Grant May 1980 42 p refs
(CUED/A-Turbo/TR-98; ISSN-0309-6521) Avail: NTIS HC A03/MF A01

The development of a computer program for the prediction of force and moment coefficients for the vibration of compressor and turbine blades having a large amount of deflection of the mean flow, using a finite element approach, is described. The program is limited to subsonic inlet and outlet flows (but can deal with local supersonic patches) and to flow without inlet vorticity and without shock waves. Results for the moment coefficients on a turbine cascade show good agreement with experiment. Author

N81-13022*# Bihrle Applied Research, Inc., Jericho, N. Y.

ROTARY BALANCE DATA FOR A SINGLE ENGINE GENERAL AVIATION DESIGN HAVING A HIGH ASPECT-RATIO CANARD FOR AN ANGLE-OF-ATTACK RANGE OF 30 DEG TO 90 DEG Final Report

William J. Mulcay and Robert Rose Washington NASA Dec. 1980 105 p refs
(Contract NAS1-14849)
(NASA-CR-3170) Avail: NTIS HC A06/MF A01 CSCL 01A

Aerodynamic characteristics obtained in a helical flow environment utilizing a rotary balance located in the Langley spin tunnel are presented in plotted form. The configurations tested included the basic airplane, various control deflections, two canard locations, and wing leading edge modifications, as well as airplane components. Author

N81-13023# National Aerospace Lab., Tokyo (Japan).

NUMERICAL STUDY OF TRANSONIC FLUTTER OF A TWO DIMENSIONAL AIRFOIL

Koji Isogai Jul. 1980 26 p refs
(NAL-TR-617T) Avail: NTIS HC A03/MF A01

Transonic flutter characteristics of a NACA64A010 airfoil with two degrees of freedom are investigated theoretically. An unsteady aerodynamic code based on the transonic small perturbation equations, which can be applied for the wide range of the reduced frequency based on semichord ($0 < \text{or} = k < 0.5$) and Mach number (from subcritical to above Mach 1), was developed. The finite difference scheme employed in the code is a time marching, semi-implicit and implicit two sweep procedure. Flutter calculations are performed for two typical binary systems, one of which simulates the vibrational characteristics of a typical streamwise section of a sweptback wing, and the other of which simulates that of an unswept wing. A sharp transonic dip of the flutter boundary was predicted for the former case while the relatively mild dip for the latter. For the purpose of identifying the possible mechanism of the transonic dip phenomenon, examinations are made of not only the flutter modes and frequencies but also the shock wave patterns and the unsteady load distributions at each Mach number corresponding to the flutter boundary. It is concluded that the mechanism of the single degree of freedom flutter, which is caused by the large negative damping produced by the phase lag of the shock wave motion, is dominating the flutters at the bottom of the transonic dip when the mass ratio is relatively large. M.G.

N81-13024# Aircraft Research Association Ltd., Bedford (England).

RESULTS OF OSCILLATORY PITCH AND RAMP TESTS ON THE NACA 0012 BLADE SECTION

M. E. Wood Dec. 1979 115 p refs
(ARA-MEMO-220) Avail: NTIS HC A06/MF A01

Two programs of dynamic tests on the NACA 0012 blade section were run in the ARA two dimensional tunnel using the two-degree-of-freedom pitch and heave rig. The tests, run in the pitching mode only, covered a range of Mach number from 0.3 to 0.9. The experimental results are compiled in the form of normal force and pitching moment hysteresis loops obtained by chordwise integration of the wing pressures. Author

N81-13025# Cambridge Univ. (England). Dept. of Engineering.

AN INTRODUCTION TO THE DISCRETE VORTEX METHOD

D. J. Maull 1979 25 p refs
(CUED/A-Aero-TR/8; ISSN-0309-7293) Avail: NTIS HC A02/MF A01

The idea of representing a vortex sheet by discrete vortices is presented. The advantage of this method over many others for solving fluid flow problems is that if the origin of the sheet in the flow is known then only the velocities on the sheet need to be calculated instead of, as in other methods, the entire flow field. This, can involve considerable computing effort and it is only relatively recently that large enough computers are available to make the method of practical use. S.F.

N81-13026# Cambridge Univ. (England). Dept. of Engineering.

MEASURED PRESSURE DISTRIBUTIONS AND SHOCK SHAPES ON A BUTLER WING

L. C. Squire 1979 18 p refs
(CUED/A-Aero/TR-9) Avail: NTIS HC A02/MF A01

Results of an experimental investigation of the flow over a delta wing designed for a Mach number of 3.5 are presented. Complete pressure distributions were measured for incidences of 0, 10 and 20 degree at Mach numbers of 2.5 and 3.5. A number of schlieren photographs of the shock system were obtained. The measurements were made to support numerical calculations. Author

N81-13027# Cambridge Univ. (England). Dept. of Engineering.

A TIME MARCHING METHOD FOR UNSTEADY TWO DIMENSIONAL FLOW IN A BLADE PASSAGE

N. A. Mitchell 1980 42 p refs
(CUED/A-Turbo/TR-100) Avail: NTIS HC A03/MF A01

A time marching method for calculating non uniform unsteady two dimensional flow through a blade passage is presented. The various problems encountered in extending time marching techniques into this field are examined, and the method is applied to analyze unsteady wake flows through a compressor and turbine blade row. Author

N81-13028# Cambridge Univ. (England). Dept. of Engineering.

STEADY AND UNSTEADY FLOW IN CASCADES BY A FINITE ELEMENT METHOD

D. S. Whitehead Apr. 1980 23 p refs
(CUED/A-Turbo/TR-99) Avail: NTIS HC A02/MF A01

A computer program generates the mesh, calculates the steady flow through the cascade, and calculates unsteady pressure distributions, force coefficients and moment coefficients due to translational and torsional motion of the blades. The program is limited to subsonic inlet and outlet flow, although it can deal with patches of supersonic flow over the blade surface. Since it assumes potential flow it cannot deal with wakes coming from upstream and with shock waves. Flow round the leading edges of thick blades is correctly handled, and the program also allows for accustic waves propagated upstream and downstream. Author

N81-13029# Cambridge Univ. (England). Dept. of Engineering.

AN EXPERIMENTAL INVESTIGATION OF SECONDARY FLOW LOSSES IN BENDS WITH RECTANGULAR CROSS SECTIONS

H. H. Bruun 1979 63 p refs
(CUED/A-Turbo/TR-95) Avail: NTIS HC A04/MF A01

Results of an experimental investigation into the secondary flow processes and associated losses in bends with rectangular cross sections are described. Detailed measurements were carried out of the time mean values of the total pressure, static pressure and velocity fields within two 120 degree bends. Combining these results with turbulence intensity measurements, a physical description is presented of the nature of the occurring secondary flow losses. S.F.

N81-13030# Cambridge Univ. (England). Dept. of Engineering.

THE PREDICTION OF BOUNDARY LAYER DEVELOPMENT

THROUGH A NORMAL SHOCK WAVE/TURBULENT BOUNDARY LAYER INTERACTION

C. J. Baker 1980 109 p refs
(CUED/A-Aero/TR-10; ISSN-0309-7293) Avail: NTIS HC A06/MF A01

A 'control volume type' method is described. In the method, control volumes are drawn around the boundary layer in the interaction region where normal pressure gradients occur, one control volume if the flow does not separate and two if separation occurs. Assuming the upstream boundary layer variables are known, this method then solves the mass and momentum conservation equations for each control volume, using an iterative method, and thus the boundary layer variables downstream of the interaction are determined. The method predicts the boundary layer development accurately when the flow does not separate and moderately well when separation occurs, provided an allowance is made for three dimensional effects. The results of numerical investigations into the effects of Mach number, Reynolds number, fluid injection and heat transfer on unseparated interactions are presented. Author

N81-13031# Naval Postgraduate School, Monterey, Calif. Dept. of Aeronautics.

TRANSONIC CASCADE WIND TUNNEL MODIFICATION AND INITIAL TESTS M.S. Thesis

Karl Ferdinand Volland, Jr. Jun. 1980 107 p refs
(AD-A091080) Avail: NTIS HC A06/MF A01 CSCL 14/2

The transonic cascade wind tunnel at the Turbomachinery Laboratory was modified by incorporting a perforated wall section in the upper nozzle block. The purpose of this modification was to cancel the oblique shock waves from the cascade blades and to aid in starting the supersonic flow in the tunnel. Tests results indicated that the modification performed successfully. Supersonic flow was established through the cascade blading which models the relative flow at the tip of the laboratory's transonic compressor. A butterfly valve must yet be installed in the cascade exhaust to produce back pressures corresponding to the compressor's transonic operation. GRA

N81-13032# Nielsen Engineering and Research, Inc., Mountain View, Calif.

AN IMPROVED INTERACTION METHOD FOR CALCULATING EXHAUST NOZZLE BOATTAIL FLOWS Final Report, 1 Sep. 1978 - 31 Dec. 1979

Gary D. Kuhn Oct. 1980 105 p refs
(Contract F40600-77-C-0008)
(AD-A091167; AEDC-TR-80-19; NEAR-TR-213) Avail: NTIS HC A06/MF A01 CSCL 20/4

A turbulent boundary layer, inviscid flow interaction method for calculating axisymmetric nozzle boattail configurations is presented. The method is applicable to flows with subsonic or supersonic free streams with Mach number in the range 0.5 - 1.5, including flows with shock wave induced separation and to bodies with either high pressure exhaust plumes or solid plume simulators. The theory and some sample calculations are presented along with detailed instructions for preparation of input data, description of output, and instructions for operation of the computer program on an IBM 370 computer. GRA

N81-13033# Pennsylvania Transportation Inst., University Park. Applied Research Lab.

UNSTEADY PRESSURE DISTRIBUTIONS ON AIRFOILS IN CASCADE

I. Chung Shen 1 Apr. 1980 155 p refs
(Contract N00024-79-C-6043)
(AD-A091173; ARL/PSU/TM-80-45) Avail: NTIS HC A08/MF A01 CSCL 20/4

The results of a study of unsteady pressure distributions in a two dimensional cascade of blades caused by spatial inflow velocity variations are presented. An existing incompressible, inviscid theory which employs a simplified vortex model in conjunction with the assumptions of thin airfoil theory has been used by Henderson and Bruce to derive expressions for the unsteady response, which includes the cascade unsteady lift and pitching moment. An alternative way to obtain these unsteady response parameters is to establish the expression for the unsteady pressure distribution. The unsteady lift and pitching moment are calculated by direct numerical integration over the unsteady pressure difference across the airfoil chord. Comparison of the computed theoretical results using these two approaches shows satisfactory agreement except when the wavelength of the velocity variations approaches the cascade blade spacing. Good agreement is also observed between the existing measured and predicted data. The effects of design parameters of a cascade, such as space chord ratio, maximum blade camber, and mean incidence angle, on the unsteady response are presented and discussed. GRA

N81-13034# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.

SUPERCRITICAL AIRFOIL TECHNOLOGY PROGRAM WAKE EXPERIMENTS AND MODELING FOR FORE AND AFT LOADED COMPRESSOR CASCADES Final Report

D. E. Hobbs, Joel H. Wagner, J. F. Dannenhoffer, and R. P. Dring Sep. 1980 122 p refs
(Contract N00019-79-C-0229)
(AD-A091378; PWA-FR-13514) Avail: NTIS HC A06/MF A01 CSCL 20/4

A procedure has been developed for designing supercritical cascade airfoils satisfying practical aerodynamic and structural requirements. The purpose of the research reported herein is to improve the calculation of flow turning and profile loss for these airfoils through the use of a model of the viscous wake. Wakes were measured in a large scale, low speed facility for two cascades. The first cascade configuration was a fore loaded supercritical design; the second was a conventional aft loaded design. The experimental results were used to analytically model the viscous wake in an inviscid potential flow calculation. GRA

N81-13035# Naval Research Lab., Washington, D. C.

INTERFACIAL CONDITIONS OF A CYLINDRICAL VORTEX SHEET

Y. T. Fung 8 Oct. 1980 21 p refs
(RR0230141)
(AD-A091234; NRL-MR-4324) Avail: NTIS HC A02/MF A01 CSCL 20/4

Interfacial conditions for a cylindrical vortex sheet or a cylindrical fluid layer with radius dependent density, velocity and magnetic fields are derived for isentropic compressible swirling flows subjected to arbitrary disturbances. Surface tension is included for possible immiscible fluids. These conditions are valid for both spatially and temporally growing waves and for flow profiles with or without discontinuities. The deformation of the sheet or layer affects the flow in two ways: perturbing the total pressure field and disturbing the centrifugal force field created by the azimuthal components of the velocity and the magnetic flux. It is shown, through the derivations of the interfacial conditions, the the Rayleigh-Synge and the Alfven discriminant are in fact a differential representation of the centrifugal force field. Both discriminants play a crucial role in the stability characteristics of Hydromagnetic swirling flows. As supported by a previously proposed mechanism, instabilities of such flows are both of centrifugal and of shear origin, the generalized Michael condition being a criterion for centrifugal stability. Centrifugal forces and velocity gradients affect flow characteristics through their interaction with the Lagrangian displacement. For centrifugally stable profiles, unstable waves with large numbers may be stabilized by centrifugal effects. This suggests a mechanism for the dilemma that the most unstable waves for flows of vortex sheet types correspond to the smallest scale disturbances that are not observed in experiments. GRA

N81-13036# Naval Surface Weapons Center, Dahlgren, Va. Strategic Systems Dept.

OPTIMAL BODIES FOR MINIMUM TOTAL DRAG AT SUPERSONIC SPEEDS Final Report

Nicholas J. Moga May 1980 57 p refs
(SF32392591)
(AD-A091235; NSWC/TR-80-208) Avail: NTIS HC A04/MF A01 CSCL 20/4

Two new methods were developed for predicting projectile shape which yield minimum total drag at supersonic speeds. The first technique is an Eulerian scheme that uses modified Newtonian theory and Prandtl-Meyer expansion for pressure drag with Van Driest skin friction and semi-empirical base drag

prediction. The second scheme iterates body coordinates with the second order shock expansion theory and the same skin friction and base drag methods to minimize the total drag. A different shape is determined for each length-to-diameter ratio and Mach number. The first technique was found to calculate a reasonably accurate optimal shape, but did not predict accurate drag coefficients. It was found that the modified Newtonian theory plus Prandtl-Meyer expansion predicted pressure drag coefficients much too low whereas the second order shock expansion method gave good results. The second technique predicted both accurate optimal shapes and drag coefficients. Optimal shapes were predicted using the second techniques for Mach numbers 2-5 and length-to-diameter ratios of 4, 5, and 6. They were found to compare well with experimental data. GRA

N81-13037# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN EXPERIMENTAL INVESTIGATION OF THE NEAR WAKE OF A CIRCULAR CYLINDER M.S. Thesis
Ronald Eugene Walterick Sep. 1980 102 p refs
(AD-A091084; AFIT/GAE/AA/805-1) Avail: NTIS HC A06/MF A01 CSCL 20/4

The near field region of the turbulent wake behind a rotating and nonrotating two dimensional circular cylinder is documented. The component mean velocities, turbulent intensities and velocity autocorrelation functions are measured at various downstream locations. From the autocorrelation functions, Taylor time microscales, longitudinal integral time scales and energy dissipation rates are computed. The measurements are performed for the flow over a circular cylinder at omega – 0 RPM and omega is approximately 500 RPM. The free stream velocity and Reynolds number, based on cylinder diameter, are respectively 5.9 m/sec and approximately 50,000. The turbulent measurements are made with a laser velocimeter using a frequency shifting phase modulator and the photon correlation processing scheme. Naturally occurring contaminant is augmented with vaporized kerosene to increase the magnitude of scattered light. Results are presented for the effects of varying omega, frequency shifting, particle concentrations and detector optics pinhole size on the turbulent quantities. GRA

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N81-13038# Transportation Systems Center, Cambridge, Mass.
VISUAL CONFIRMATION (VICON) OF VOICE TAKE-OFF CLEARANCE OF COST-AND-DEPLOYMENT ANALYSES AND STRATEGIES Final Report, Jan. 1978 - Aug. 1980
John R. Coonan Sep. 1980 31 p refs
(Contract DOT-FA021R-0119)
(AD-A091007; TSC-FAA-80-16; FAA-RD-80-108) Avail: NTIS HC A03/MF A01 CSCL 01/2

The first results of a program undertaken by the Transportation Systems Center are presented. Cost and deployment strategies of VICON installation were studied over a four year period. E.D.K.

N81-13039# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Crew Escape and Subsystems Branch.
EVALUATION OF THE IMPACT COMPUTER PROGRAM AS A LINEAR DESIGN TOOL FOR BIRD RESISTANT AIRCRAFT TRANSPARENCIES Final Report, 1 Jan. - 1 Aug. 1978
Robert E. McCarty Mar. 1980 166 p refs
(AF Proj. 2402)
(AD-A091051; AFFDL-TR-79-3103) Avail: NTIS CSCL 01/3

The use of a finite element structural analysis computer program called IMPACT to simulate the transient response of B-1 aircraft windshield panels to bird impact is discussed. For the two simulations accomplished, computed results were compared to experimental data acquired during bird impact tests of actual windshield panels. For the first case of a panel tested at ambient temperature, the computed results were qualitatively accurate. Strain levels measured during the test exceeded those calculated by IMPACT, however, and the disagreement was attributed to the presence of geometric nonlinearities in the test structure the effects of which were not accounted for in the IMPACT analysis. For the second case of a panel heated to an outer surface temperature of 220 deg F the computed results were unreasonable. Disagreement between computed and experimental data was attributed to errors in the theoretical formulation or coding of IMPACT relating to its capability to account for the effects of elevated temperatures or temperature gradients within the structure. Continued development of IMPACT is not recommended; a currently available fully nonlinear finite element program is identified which has more potential of serving as a transparency birdstrike analysis tool. GRA

N81-13040# Martin Marietta Corp., Orlando, Fla.
PERFORMANCE VERIFICATION OF THE SUPERJET LAMINAR ANGULAR RATE SENSOR Final Report, 5 Nov. 1979 - 5 May 1980
Boyd W. Curry, Jr. May 1980 311 p refs
(Contract DAAK40-79-D-0017)
(AD-A091089; OR-16127; NADC-80081-60) Avail: NTIS HC A14/MF A01 CSCL 01/3

The need exists for small rugged rate sensors applicable to the Navy's Maximum Performance Escape System. A recent study indicated that a prime candidate for this system is the Superjet rate sensor used on the U.S. Army Copperhead Program. The purpose of this performance verification task is to determine through test and analyses the suitability of the Hamilton-Standard Superjet angular rate sensor for the possible application in NADC's Maximum Performance Escape System (MPES) program. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N81-13041# Committee on Science and Technology (U. S. House).
AIRCRAFT COLLISION AVOIDANCE
Washington GPO 1979 682 p refs Hearings before the Subcomm. on Transportation, Aviation and Commun. of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., no. 29, 27-28 Jun. and 24 Jul. 1979
(GPO-50-158) Avail: Subcommittee on Transportation, Aviation and Communications

Prevention of midair collisions was investigated. Aircraft approach spacing along with improvements in air traffic control were examined. The possible implementation of warning systems and the available technology was studied. T.M.

N81-13042# Federal Aviation Administration, Atlantic City, N.J.
TOWER CAB DIGITAL DISPLAY Final Report, Jan. - Mar. 1980
Philip Karsten Sep. 1980 18 p refs
(AD-A090616; FAA-CT-80-31; FAA/RD-80-101) Avail: NTIS HC A02/MF A01 CSCL 01/5

This report discusses the operational evaluation of the Tower Cab Digital Display (TCDD). The TCDD is used for air traffic control operations in the St. Petersburg control tower and the MacDill Air Force Base ground control approach (GCA) and control tower facilities as part of the Automated Radar Terminal System (ARTS) 3A Remote Tower Display System. Evaluation objectives were to determine the usefulness and suitability of TCDD operational features. Resultant findings will be input to the Systems Research and Development Service (SRDS) technical data package for future production TCDD's. For the most part, resultant findings are favorable to existing TCDD capabilities.

Some modifications are recommended for future production models. GRA

N81-13043# Mitre Corp., McLean, Va.
TECHNICAL ISSUES RELATED TO THE USE OF LORAN-C IN TERRESTRIAL APPLICATIONS Final Report, 1 Jul. - 15 Nov. 1979
Dec. 1979 50 p refs
(Contracts DOT-HS-7-01549; DOT-NHTSA-9-6-6701)
(PB80208184; DOT-HS-805446) Avail: NTIS HC A03/MF A01 CSCL 17G

The extension of LORAN-C operations from marine services to terrestrial vehicle tracking applications in urban centers is discussed. Two sucessful experimental vehicle tracking systems, one in Philadelphia, Pa., and the other in Washington, D.C. are described. The LORAN-C receiver parameters which must be upgraded for terrestrial use are identified and minimum receiver performance characteristics suggested for land based vehicle tracking. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N81-13044*# Lockheed-California Co., Burbank.
YF-12 COOPERATIVE AIRFRAME/PROPULSION CONTROL SYSTEM PROGRAM, VOLUME 1 Final Report
D. L. Anderson, G. F. Connolly, F. M. Mauro, P. J. Reukauf, and Ralph Marks, ed. Nov. 1980 120 p refs 2 Vol.
(NASA-CR-163099; SP-5317; H-1136) Avail: NTIS HC A06/MF A01 CSCL 01C

Several YF-12C airplane analog control systems were converted to a digital system. Included were the air data computer, autopilot, inlet control system, and autothrottle systems. This conversion was performed to allow assessment of digital technology applications to supersonic cruise aircraft. The digital system was composed of a digital computer and specialized interface unit. A large scale mathematical simulation of the airplane was used for integration testing and software checkout. Author

N81-13045# Committee on Science and Technology (U. S. House).
DESIGN ANALYSIS OF WIDE-BODY AIRCRAFT
Washington GPO 1980 562 p Hearings before the Subcomm. on Invest. and Oversight of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., no. 98, 17-18, 21 Jul., 6, 15 Aug. and 4 Oct. 1980
(GPO-60-652) Avail: Subcommittee on Investigations and Oversight

Technical design details of the DC-10, such as pylons, slats, and cockpit stall indications were examined. The various design philosophies for wide body aircraft and the research and development upon which those philosophies are based were investigated. T.M.

N81-13046# Pacer Systems, Inc., Burlington, Mass.
STUDY OF HELICOPTER PERFORMANCE AND TERMINAL INSTRUMENT PROCEDURES Final Report
A. G. DeLucien, D. L. Green, H. R. Price, and F. D. Smith Jun. 1980 188 p refs
(Contract DOT-FA79WAI-019)
(AD-A090052; FAA-RD-80-58) Avail: NTIS HC A09/MF A01 CSCL 01/3

In an effort to provide data needed to examine the feasibility of new procedures and criteria for terminal instrument procedures, this study effort addresses helicopter IFR operations in two parts. First, it documents, in a collective sense, the Instrumental Meteorological Conditions and Visual Meteorological Conditions performance capabilities of currently IFR certified helicopters. A number of proposed helicopter procedures are analyzed for their suitability for further consideration or experimental testing, considering the current helicopter parametric performance envelopes. Second, helicopter instrument procedures are addressed in the long term sense and recommendations are offered for development of post 1985 operations. GRA

N81-13047# Bell Helicopter Co., Fort Worth, Tex.
EXPERIMENTAL INSTALLATION OF MAST MOUNTED SIGHT ON AN OH-58C HELICOPTER Final Report, Mar. 1978 - Jan. 1980
James A. Rule, Horace W. Hanson, Harry K. Harr, John R. Norvell, and David A. Popelka Oct. 1980 82 p refs
(Contract DAAK10-78-C-0115; DA Proj. 1L2-63206-D-043)
(AD-A091074; USAAVRADCOM-TR-80-D-25) Avail: NTIS HC A05/MF A01 CSCL 01/3

The purpose of this effort was to investigate the load and vibration effects of installing a Rockwell mast mounted sight (MMS) on an OH-58C helicopter and to determine the environment in which the sight would operate. The task consisted of analytical studies, tests with a dummy sight, and installation and test of an operational sight. GRA

N81-13048# Goodyear Aerospace Corp., Litchfield Park, Ariz.
SUPERHARD TRANSPARENT COATING OPTIMIZATION PROGRAM Final Report
Richard S. Hassard, Glenn E. Wintermute, and John Uram, Jr. Sep. 1980 43 p refs
(Contract DAAK51-79-C-0047; DA Proj. 1L1-62209-AH-76)
(AD-A091083; GERA-2448) Avail: NTIS HC A03/MF A01 CSCL 11/3

This report covers the results of a study program for the optimization of a hard transparent coating that was previously developed and laboratory tested by Goodyear Aerospace Corp. Subsequent field tests of the coating on UH-1 helicopter windows revealed certain deficiencies which this program was designed to overcome. Modifications of the No. 210 coating consisted primarily of discrete changes in the quantities of the reactive components. GRA

N81-13049# San Antonio Air Logistics Center, Kelly AFB., Tex.
CONTAMINANT INCREASE IN AIRCRAFT LIQUID OXYGEN CONVERTERS: ANALYSIS OF DATA Progress Report, Mar. - May 1979
Lester L. Dziuk Aug. 1980 22 p
(AD-A090975; SAALC/SFQ-TR-80-1) Avail: NTIS HC A02/MF A01 CSCL 07/2

Analysis of data collected during a study of contaminant buildup in an aircraft liquid oxygen converter is presented. The data indicates that contaminants increase during the interval between fillings and that contaminants are removed during fillings. No overall trend of contaminant increase was observed. GRA

N81-13050# Human Engineering Labs., Aberdeen Proving Ground, Md.
HELICOPTER IN-FLIGHT VALIDATION SYSTEM (HELIVALS) Final Report
Thomas L. Frezell, Gordon Herald, Richard S. Camden, and Clarence A. Fry Aug. 1980 25 p refs
(AD-A091129; HEL-TM-17-80) Avail: NTIS HC A02/MF A01 CSCL 14/3

This report described the Helicopter In-Flight Validation System (HELIVALS). The system monitors all six degrees of freedom of the helicopter flight control position to include cyclic, collective and anti-torque pedals; along with airspeed, altitude (both barometric and absolute), and geographic position. These data are recorded digitally on a magnetic tape recorder mounted in the helicopter. The recorded data is then processed and reduced in a ground station. GRA

N81-13051 Maryland Univ., College Park.
DYNAMICS OF A HELICOPTER-SLUNG LOAD SYSTEM Ph.D. Thesis
Prasad Sampath 1980 164 p
Avail: Univ. Microfilms Order No. 8027137

Stability of a tandem rotor helicopter carrying a slung cargo container was investigated. Lagrange equations were used to write the equations of motion. The cables of the sling were modeled as massless rigid extensible rods, which collapse under compressive loads. Extensibility was provided by considering the

rods as linear springs with viscous damping. Aerodynamics of the cable were neglected. Tabulated static aerodynamic data were considered for the helicopter as well as the load. The equations were divided into two sets, one representing the towing vehicle (referred to as Subsystem 1) and the other representing the slung load (referred to as Subsystem 2). Subsystem 2 corresponds to a wind tunnel model of a slung load. Stability of Subsystem 2 was investigated for various flow velocities and sling configurations. The results were compared with the results of wind tunnel tests of scaled models. The influence of the load oscillations on the helicopter is substantially reduced when the helicopter is flown with its stability augmentation system on. Without the intervention of the pilot, load oscillations cause the helicopter, with or without the stability augmentation system, to oscillate. Pilot inputs can also induce oscillations in the load.
Dissert. Abstr.

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N81-13052# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuerung.
AN EQUIPMENT FOR TESTING AND MEASURING A HELMET MOUNTED SIGHT AND DISPLAY SYSTEM WITH A COUPLED TV-CAMERA IN THE FLIGHT SIMULATOR FOR RESEARCH OF THE DFVLR
Friedrich Erdmann Jan. 1980 81 p refs In GERMAN; ENGLISH summary
(DFVLR-MITT-80-04) Avail: NTIS HC A05/MF A01

Equipment for testing a helmet sight and display system (HMS/D) in a flight simulator for research is described. The values to be measured and the corresponding reference values are defined. The software and hardware of the testing equipment, the control program of the equipment, and the methods of data recording are presented. Special aspects of the mathematical background and measurement of static errors of a HMS/D system (Honeywell) are given in the appendixes. E.D.K.

N81-13053# Boeing Commercial Airplane Co., Seattle, Wash.
AIRCRAFT ALERTING SYSTEMS STANDARDIZATION STUDY Final Report, Jan. - Nov. 1979
G. P. Boucek, J. B. Erickson, B. L. Berson, D. C. Hanson, and M. F. Leffler Feb. 1980 372 p refs Prepared in cooperation with Douglas Aircraft Co., Santa Monica, Calif. and Lockheed Aircraft Corp., Sunnyvale, Calif.
(Contract DOT-FA79WA-4268)
(AD-A090834; D6-49273; FAA-RD-80-68) Avail: NTIS HC A16/MF A01 CSCL 01/4

This report is one of a series of documented studies and experiments directed to the improvement and standardization of cockpit alerting systems. The efforts in this current study are noteworthy in that the three major manufacturers of Commercial Transport Aircraft, Douglas, Lockheed, and Boeing conducted the tests and co-authored this report. The primary purpose of the study is to extend and validate, through simulation, the precepts advanced in the previous contract study. The primary purpose of this report is to document the results of objective and subjective tests and the development of the functional design of the candidate alerting systems which will be implemented and evaluated in a flight simulator. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

N81-13054 Virginia Polytechnic Inst. and State Univ., Blacksburg.
AN INVESTIGATION OF THE DYNAMIC STALLING CHARACTERISTICS OF ROTATING AXIAL-FLOW COMPRESSOR BLADES Ph.D. Thesis
Michael Ray Sexton 1980 199 p
Avail: Univ. Microfilms Order No. 8028161

Data taken while the experimental compressor was operating with a distortion screen upstream of the rotor was utilized to develop a transfer function was developed by considering the dynamic total pressure loss distribution around the rotor to be a response function driven by a quasi-steady total pressure loss distribution as a forcing function. Fourier transforms of both the dynamic and the quasi-steady distributions were calculated. The quotient obtained by dividing the Fourier transform of the response function by the Fourier transform of the forcing function was the desired transfer function. This experimentally determined transfer function was then used in a new semi-actuator disc model to predict the dynamic response of the experimental compressor. Dissert. Abstr.

N81-13055 Illinois Inst. of Tech., Chicago.
EFFECTS OF AXISYMMETRIC CONTRACTIONS ON TURBULENCE OF VARIOUS SCALES Ph.D. Thesis
Jimmy Tan-Atichat 1980 393 p
Avail: Univ. Microfilms Order No. 8026159

Digitally acquired and processed results from an experimental investigation of grid-generated turbulence of various scales through and downstream of nine matched cubic axisymmetric contractions ranging in area ratio from 2 to 36, and in length-to-inlet diameter ratio from 0.25 to 150. In addition, a fifth order contraction was utilized for studying the contour shape effect were examined. Key features of this experiment included powering the wind tunnel with compressed air to eliminate minute extraneous velocity fluctuations caused by the blower fan blades which amplify and affect the components of turbulent kinetic energy unequally in a contracting stream, and the concurrent utilization of both digital and analog instrumentation to achieve a higher quality of the recorded data. Results indicate that the extent to which the turbulence is altered by the contraction depends on the incoming turbulence scales, the total strain experienced by the fluid, as well as the contraction ratio and the strain rate. Dissert. Abstr.

N81-13056*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NASA RESEARCH IN AEROPROPULSION
Warner L. Stewart and Richard J. Weber 1981 24 p Proposed for presentation at the 26th Ann. Intern. Gas Turbine Conf., Houston, Tex., 8-12 Mar. 1981; sponsored by the ASME
(NASA-TM-81633; E-645) Avail: NTIS HC A02/MF A01 CSCL 21E

Selected examples of recent accomplishments and current activities that are relevant to the principal classes of civil and military vehicles: subsonic transports, commuters, supersonic transports, general aviation, rotorcraft, V/STOL, and high performance. Some instances of emerging technologies with potential high impact on further progress are discussed. E.D.K.

N81-13057*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.
MODEL AERODYNAMIC TEST RESULTS FOR TWO VARIABLE CYCLE ENGINE COANNULAR EXHAUST SYSTEMS AT SIMULATED TAKEOFF AND CRUISE CONDITIONS Final Report
D. P. Nelson 17 Dec. 1980 70 p refs
(Contract NAS3-20061)
(NASA-CR-159818; PWA-5550-37) Avail: NTIS

HC A04/MF A01 CSCL 21E

Wind tunnel tests were conducted to evaluate the aerodynamic performance of a coannular exhaust nozzle for a proposed variable stream control supersonic propulsion system. Tests were conducted with two simulated configurations differing primarily in the fan duct flowpaths: a short flap mechanism for fan stream control with an isentropic contoured flow splitter, and an iris fan nozzle with a conical flow splitter. Both designs feature a translating primary plug and an auxiliary inlet ejector. Tests were conducted at takeoff and simulated cruise conditions. Data were acquired at Mach numbers of 0, 0.36, 0.9, and 2.0 for a wide range of nozzle operating conditions. At simulated supersonic cruise, both configurations demonstrated good performance, comparable to levels assumed in earlier advanced supersonic propulsion studies. However, at subsonic cruise, both configurations exhibited performance that was 6 to 7.5 percent less than the study assumptions. At take off conditions, the iris configuration performance approached the assumed levels, while the short flap design was 4 to 6 percent less. Author

N81-13058*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

EVALUATION OF A BULK CALORIMETER AND HEAT BALANCE FOR DETERMINATION OF SUPERSONIC COMBUSTOR EFFICIENCY

C. R. McClinton and G. Y. Anderson Dec. 1980 45 p refs (NASA-TP-1739; L-13943) Avail: NTIS HC A03/MF A01 CSCL 21E

Results are presented from the shakedown and evaluation test of a bulk calorimeter. The calorimeter is designed to quench the combustion at the exit of a direct-connect, hydrogen fueled, scramjet combustor model, and to provide the measurements necessary to perform an analysis of combustion efficiency. Results indicate that the calorimeter quenches reaction, that reasonable response times are obtained, and that the calculated combustion efficiency is repeatable within + or -3 percent and varies in a regular way with combustor model parameters such as injected fuel equivalence ratio. Author

N81-13059# Cambridge Univ. (England). Dept. of Engineering.

GERRY CASING TREATMENT

D. S. Whitehead, N. Hall, and A. Poursartip May 1980 24 p refs

(CUED/A-Turbo/TR-101) Avail: NTIS HC A02/MF A01

Three different configurations were tested. A semi-circular circumferential groove in the outer casing centered on the trailing edge of the blade row caused no significant improvements in the stall margin. With the addition of shoulders and ramps downstream of the groove the performance suffered a small but definite deterioration. Axial velocity, and outlet flow angle downstream of the rotor were also obtained for all configurations. Author

N81-13060# Army Propulsion Lab., Cleveland, Ohio. Propulsion Lab.

THE RESPONSE OF TURBINE ENGINE ROTORS TO INTERFERENCE RUBS

Albert F. Kascak Jun. 1980 15 p refs

(AD-A090408) Avail: NTIS HC A02/MF A01 CSCL 21/5

In a typical aircraft gas turbine there are many instances in which rotor rubs occur. Two of the most common are blade tip and seal rubs, which are caused by thermal mismatch, rotor imbalance, high 'g' maneuver loads, aerodynamic forces, etc. Current interest in fuel efficiency is a consideration which drives the engine design toward closer operating clearances. Thus increasing the probability of rotor rubs. The interaction of a rotor with its case, (rotor rubs), has been studied. A steady state interaction between a rotor with a rigid case neglecting friction at the interface and a steady state interaction between a linear flexible rotor and case including friction at the interface were studied. The critical transient situation in which the rotor bounces off the case was not considered. It is known that rotor rubs can have an important effect on the rotor dynamics. When a rotor rubs on the case, a frictional force is generated which can drive a rotor to whirl in a direction opposite to the direction of rotation, (backward whirl). This frictional force is relatively constant up to the backward whirl speed at which the rotor rolls around the case. Since this rolling contact speed is proportional to the rotational speed of the rotor times the ratio of the diameter to the rotor clearance, the whirl speed can be hundreds of times the rotational speed of the rotor; and thus be potentially very dangerous. GRA

N81-13061# ARO, Inc., Arnold Air Force Station, Tenn.

PERFORMANCE EVALUATION OF A PROTOTYPE NON-INTERFERENCE TECHNIQUE FOR MEASUREMENT OF TURBINE ENGINES COMPRESSOR BLADE STRESS Final Report, 1 Oct. 1977 - 1 Jan. 1979

P. E. McCarty and J. W. Thompson, Jr. AEDC Oct. 1980 23 p refs Sponsored by AF

(AD-A090566; AEDC-TR-80-5) Avail: NTIS HC A02/MF A01 CSCL 21/5

A noninterference technique for measuring stress in compressor blades of turbine engines is being developed to alleviate disadvantages associated with conventional strain gage measurement systems. The noninterference technique uses blade-tip deflection measurements and special data processing algorithms to infer local blade stress. A prototype of the noninterference technique equipped with a nonintegral blade vibration data processing algorithm has been experimentally validated. GRA

N81-13062# Federal Aviation Administration, Atlantic City, N.J.

EXHAUST EMISSIONS CHARACTERISTICS AND VARIABILITY FOR PRATT AND WHITNEY JT8D-7A GAS TURBINE ENGINES SUBJECTED TO MAJOR OVERHAUL AND REPAIR Final Report, Nov. 1978 - Feb. 1979

Eric E. Becker, Gary Frings, and William C. Cavage Sep. 1980 55 p refs

(FAA Proj. 201-521-100)

(AD-A091011; FAA-CT-79-53) Avail: NTIS HC A04/MF A01 CSCL 21/5

Seven Pratt and Whitney Aircraft (PWA) JT8D-7A turbofan engines were tested at Kennedy International Airport, New York, to evaluate exhaust emissions characteristics and data variability after overhaul. The measured data show that the engines tested did not meet the Environmental Protection Agency (EPA) emission standards. A comparison of the measured data, obtained from the seven overhauled engines evaluated under this program, with new engine data obtained from PWA show that there is a great deal of similarity between the two sets of data. Differences shown in this report between new engine and overhauled engine data are due to the quantity of the engines sampled; the new engine data represent a larger sample size. Satisfactory data can be measured by using the test procedures, instrumentation, and equipment defined in this report. GRA

N81-13063# Georgia Inst. of Tech., Atlanta. Electromagnetics Lab.

THE KINETICS AND SPECTROSCOPY OF A AIRCRAFT AND ROCKET PLUME CONSTITUENTS Interim Report, 1 Jun. 1979 - 31 May 1980

A. R. Ravishankara and F. P. Tully 30 Aug. 1980 18 p refs (Contract F49620-77-C-0111; AF Proj. 2308)

(AD-A090948; AFOSR-80-1006TR; IR-3) Avail: NTIS HC A02/MF A01 CSCL 21/1

Utilizing the technique of flash photolysis resonance fluorescence the rate constants for the reactions of hydroxyl radicals (OH) with deuterium, hydrogen chloride, and propane were measured at elevated temperatures as high as 1000 K. Distinct curvature was observed in the Arrhenius plots for OH reactions with HC1 and propane while the OH - D2 reaction rate coefficient seemed to follow the Arrhenius law quite well. The measured rate constants were compared with previous measurements in the literature. GRA

N81-13064# Battelle Columbus Labs., Ohio.

MECHANICAL PROPERTY IMPROVEMENT OF PROTECTIVE COATINGS FOR TURBINE ENGINES USING COAL-DERIVED FUELS Final Report

H. A. Beale 1 Sep. 1980 21 p refs

(Contract DE-AC03-78ET-12293)

(DOE/ET-12293/T1) Avail: NTIS HC A02/MF A01

Nb-NbC and Nb-NbB2 coatings were studied to determine, how thermal expansion differences between a metal matrix and

a dispersed phase affect the coating properties. The Nb-NbC and Nb-Nb-NB2 coatings were deposited by dual source electron beam evaporation. Transmission electron microscopic (TEM) examination of the deposited coatings revealed that the NbC and NbB2 in the coating was randomly dispersed with particle size of less than 50 A. The effect of such finely dispersed particles on the Peierls stress in the coating was found to have negligible impact on the coating properties. DOE

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N81-13065*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

PSEUDOSTEADY-STATE ANALYSIS OF NONLINEAR AIRCRAFT MANEUVERS

John W. Young, Albert A. Schy, and Katherine G. Johnson Dec. 1980 64 p refs

(NASA-TP-1758; L-13743) Avail: NTIS HC A04/MF A01 CSCL 01C

An analytical method was developed for studying the combined effects of rotational coupling and nonlinear aerodynamics on aircraft response for specified control inputs. The method involves the simultaneous solution of two nonlinear equations which are functions of angle attack, roll rate, and control inputs. The method was applied to a number of maneuvers for a fighter-type aircraft. Time history responses verified the usefulness of the analysis for predicting a variety of response characteristics caused by interacting nonlinear aerodynamic and inertial effects, including spin conditions. Author

N81-13066*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

COMPARISON OF SPACE SHUTTLE ORBITER LOW-SPEED STATIC STABILITY AND CONTROL DERIVATIVES OBTAINED FROM WIND-TUNNEL AND APPROACH AND LANDING FLIGHT TESTS

Delma C. Freeman, Jr. and Bernard Spencer, Jr. Dec. 1980 36 p refs

(NASA-TP-1779; L-13945) Avail: NTIS HC A03/MF A01 CSCL 01C

Tests were conducted in the 8 foot transonic pressure tunnel to obtain wind tunnel data for comparison with static stability and control parameters measured on the space shuttle orbiter approach and landing flight tests. The longitudinal stability, elevon effectiveness, lateral directional stability, and aileron effectiveness derivatives were determined from the wind tunnel data and compared with the flight test results. The comparison covers a range of angles of attack from approximately 2 deg to 10 deg at subsonic Mach numbers of 0.41 to 0.56. In general the wind tunnel results agreed well with the flight test results, indicating the wind tunnel data is applicable to the design of entry vehicles for subsonic speeds over the angle of attack range studied. E.D.K.

N81-13067# Air Force Wright Aeronautical Labs., Wright-Patterson AFB, Ohio. Flight Control Div.

DESIGN OF A LATERAL STABILITY AUGMENTATION SYSTEM FOR THE F106 TO IMPROVE LATERAL HANDLING QUALITIES DURING TRACKING Final Technical Report, May 1977 - Jan. 1979

Richard D. Holdridge Jul. 1980 165 p refs

(AF Proj. 2403)

(AD-A091014; AFWAL-TR-80-3015) Avail: NTIS HC A08/MF A01 CSCL 01/2

An improved lateral stability augmentation system has been developed to improve the handling qualities of the F-106 in the air-to-air tracking task. The existing yaw rate and roll rate feedbacks, as well as the aileron to rudder interconnect, were removed and replaced with calculated sideslip rate and measured sideslip feedbacks. An advanced root locus technique, the root map was used to set the gains on sideslip and sideslip rate. The resulting system was evaluated using a nonpiloted hybrid simulation as well as a digital frequency domain analysis program. The system was then evaluated by operational F-106 pilots using the Flight Dynamics Laboratory's LAMARS motion based simulator. Based on simulator results, the system was installed on an F-106 and flight tested at Tyndall AFB, Florida. The results of basic analyses, nonpiloted simulations, piloted simulations, and flight test are presented. GRA

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N81-13068# ARO, Inc., Arnold Air Force Station, Tenn.

A DIRECT MODEL PITCH MEASUREMENT WITH A LASER INTERFEROMETER USING RETROREFLECTORS Final Report, Oct. 1978 - 5 Sep. 1979

W. H. Goethert AEDC Jan. 1980 42 p ref Sponsored by AF

(AD-A090722; AEDC-TR-79-87) Avail: NTIS HC A03/MF A01 CSCL 20/6

A laser interferometer was developed to measure pitch angles of test models in a wind tunnel environment. Small retroreflectors imbedded flush with the surface of the test item provided the necessary reflected light for optical processing of pitch information. The first tunnel measurements indicated pitch measurements could be made providing the retroreflectors remained illuminated with the expanded laser beams. Because of the axial motion of the model relative to the optics systems, provisions for scanning the laser beams to follow retroreflector motion was incorporated. Using an actual test model, data were taken demonstrating this tracking capability. Calibration data were also taken comparing the interferometer data with the tunnel standard inclinometer. GRA

N81-13069# Federal Aviation Administration, Washington, D.C. Airports Service.

AIRPORT CRASH/FIRE/RESCUE CFR SERVICE COST AND BENEFIT ANALYSIS. VOLUME 2: APPENDIXES

Jul. 1980 263 p

(AD-A091155; FAA-AS-80-2-Vol-2) Avail: NTIS HC A12/MF A01 CSCL 13/12

Contents: national CFR equipment inventory; the 221 air carrier accidents with potential CFR benefits selected in pass one; the 129 air carrier accidents that pass two determined to provide no CFR benefits; a list of the 61 air carrier accidents studied in detail in pass three for which NTSB records were available; the 31 air carrier accidents for which detailed NTSB were unavailable; description of the 61 air carrier accidents studied in detail in pass three for which NTSB records were available; and estimates of CRF crash benefits for air carrier accident, 1966-1978. GRA

N81-13070# Naval Postgraduate School, Monterey, Calif. Dept. of Aeronautics.

EVALUATION OF FACTORS AFFECTING REPEATABILITY AND ACCURACY OF TURBINE RIG TEST RESULTS M.S. Thesis

Terry Paul Eargle Jun. 1980 297 p refs

(AD-A091058) Avail: NTIS HC A13/MF A01 CSCL 14/2

An experimental study was carried out to resolve anomalies and to determine the sources of inaccuracies which had hitherto been present in results from the Turbine Test Rig at the NPS Turbopropulsion Laboratory. Internal modifications to the rig's waterbrake dynamometer are reported which improved the RPM control everywhere but in the range 17,000 - 18,500 RPM. From an analysis of test results and theoretical estimates, it was concluded that with normal atmospheric humidity supply temperatures close to 700 R were necessary to eliminate the influence of water condensation on blade row performance

measurements, since the stator nozzles were supersonic. A detailed uncertainty analysis was carried out which successfully isolated the major causes of inaccuracies in loss data derived from rig measurements. Recommendations were made which, if followed, should result in repeatable and accurate measurements of blade row losses. GRA

N81-13071# Hebrew Univ., Jerusalem (Israel).
PROCEEDINGS OF THE 12TH INTERNATIONAL SYMPOSIUM ON SHOCK TUBES AND WAVES Final Report, 30 Sep. 1978 - 31 Dec. 1979
Assa Lifshitz, ed. and Josef Rom, ed. (Israel Inst. of Tech.) Feb. 1980 744 p refs Symp. held in Jerusalem, 16-19 Jul. 1979 (Grant AF-AFOSR-3679-78; AF Proj. 2307)
(AD-A091010; AFOSR-80-1141TR) Avail: NTIS HC A99/MF A01 CSCL 20/4

The papers in the volume are divided into three parts and arranged according to their presentation at the symposium. The first part contains the plenary lectures (sessions A) including the Paul Vieille (1A) and the Otto Laporte (7A) memorial lectures. The second part contains all the papers presented in sessions B and deals with the general field of shock waves and gasdynamics. Topics covered in these sessions included shock tube facilities, shock flow computations, ionized gases in shock waves, instrumentation and experimental techniques, shock reflections and interactions, shock waves and jets, and plasma flow. The papers in the third part are those presented in sessions C. They describe work related to chemical and physical processes in shock waves. Topics covered were chemical rate processes, detonations, diagnostics and experimental methods, lasers and energy and waves. GRA

N81-13072# Pacer Systems, Inc., Arlington, Va.
STUDY OF HELIPORT AIRSPACE AND REAL ESTATE REQUIREMENTS Final Report, Mar. - Jul. 1980
A. G. DeLucien and F. D. Smith Aug. 1980 150 p refs (Contract DOT-FA79WAI-019)
(AD-A091156; FAA-RD-80-107; PAR-037-80) Avail: NTIS HC A07/MF A01 CSCL 01/5

This report documents the review and evaluation of real estate and airspace requirements as set forth in applicable U.S. heliport design criteria. International criteria are reviewed to discern their rationale for various requirements. Helicopter performance during normal and failure state operations is analyzed. The suitability of current criteria is examined with respect to various operational profiles. Modifications to current criteria are suggested which would accommodate various operational requirements and varying levels of terminal instrument procedures capability. Recommendations include a revised heliport classification scheme with corresponding changes to real estate and airspace criteria for IFR operations; helicopter performance chart standardization for flight manuals with specific data requirements; consideration of obstacle clearance for failure-state operations; additional criteria for offshore facilities; and revised criteria for elevated heliports/helipads. GRA

N81-13073# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.
STING INTERFERENCE EFFECTS AS DETERMINED BY MEASUREMENTS OF DYNAMIC STABILITY DERIVATIVES, SURFACE PRESSURE, AND BASE PRESSURE FOR MACH NUMBERS 2 THROUGH 8 Final Report, 25 May 1977 - 2 Mar. 1978
Bob L. Uselton and Fred B. Cyran AEDC Oct. 1980 149 p refs
(AD-A091115; AEDC-TR-79-89) Avail: NTIS HC A07/MF A01 CSCL 20/4

Wind tunnel tests were conducted to provide support interference information for planning and directing wind tunnel tests at supersonic and hypersonic Mach numbers. Sting-length and sting-diameter effects on base and surface pressures of a blunt 6-deg cone with a sliced base were investigated at Mach numbers 2, 3, 5, and 8. Dynamic stability tests on a blunt 7-deg cone were also conducted at Mach numbers 2, 5, and 8. The objectives of the 7-deg cone tests were to define critical sting lengths as determined by the measurement of dynamic stability derivatives, static pitching moment, and base pressure. Two frequencies of oscillation were investigated, and data were obtained for laminar, transitional, and turbulent boundary layer conditions at the model base. The data from the 6- and 7-deg cone tests showed that the critical sting length depended on the interference indicator, Mach number, angle of attack, state of the model boundary layer, and frequency of oscillation. The critical sting length was generally less for models with turbulent boundary layers than for those with laminar boundary layers. A critical sting length of 2.5 model diameters was determined to be suitable for all test conditions that produced a turbulent boundary layer at or ahead of the model base. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N81-13074* National Aeronautics and Space Administration, Washington, D. C.
HIGHLIGHTS OF 1980 ACTIVITIES
24 Dec. 1980 18 p
(NASA-News-Release-80-199; P80-10206) Avail: NASA Scientific and Technical Information Facility, P. O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

Progress in the Space Transportation System is reported. A review of the Voyager 1 mission is presented along with a summary of facts gathered on its Saturn encounter. Research and development in energy technology, space tracking, and data systems is described. T.M.

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air).*

N81-13075*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
CONCEPTUAL DESIGN STUDY SCIENCE AND APPLICATION SPACE PLATFORM SASP. VOLUME 1: EXECUTIVE SUMMARY
Fritz C. Runge Oct. 1980 27 p refs 3 Vol.
(Contract NAS8-33592)
(NASA-CR-161615; MDC-G9246-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 22B

The system design philosophy applied in the development of this platform concept is summarized. The system is to provide for simple, low cost, initial capability of accommodating Spacelab payloads that are modified for long duration flight. The supporting research and technology are also summarized. T.M.

N81-13076*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
CONCEPTUAL DESIGN STUDY SCIENCE AND APPLICATIONS SPACE PLATFORM SASP. VOLUME 2: TECHNICAL REPORT
Fritz C. Runge Oct. 1980 482 p refs 3 Vol.
(Contract NAS8-33592)
(NASA-CR-161616; MDC-G9246-Vol-2) Avail: NTIS HC A21/MF A01 CSCL 22B

The platform payload accommodations, configuration drivers, and power system are described in detail. The platform design was analyzed and is presented. Demonstration tests are described and the results are reported. T.M.

N81-13077*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
CONCEPTUAL DESIGN STUDY SCIENCE AND APPLICATIONS SPACE PLATFORM SASP. VOLUME 3: PROGRAMMATICS, COST AND SCHEDULE REPORT
Fritz C. Runge Oct. 1980 59 p refs 3 Vol.
(Contract NAS8-33592)
(NASA-CR-161617; MDC-G9246-Vol-3) Avail: NTIS HC A04/MF A01 CSCL 22B

Mission planning and project management methods are described. Cost estimates for the project are presented. A review of scheduling, budgeting, and facilities is also presented. T.M.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N81-13078* National Aeronautics and Space Administration, Washington, D. C.
THE 1981 EXPENDABLE LAUNCH VEHICLE SCHEDULE ANNOUNCED
24 Dec. 1980 3 p
(NASA-News-Release-80-198; P80-10205) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

Fifteen satellite launchings are summarized. Included in the 1981 schedule are two NASA scientific payloads, two weather satellites, and eight commercial geosynchronous communications satellites. T.M.

N81-13079*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
***ELECTRIC PROPULSION* - CHARACTERISTICS, APPLICATIONS, AND STATUS**
Joseph E. Maloy, Carl R. Dulgeroff (Hughes Research Labs., Malibu, Calif.), and Robert E. Poeschel (Hughes Research Labs., Malibu, Calif.) 1981 14 p refs
(NASA-TM-81630; E-640) Avail: NTIS HC A02/MF A01 CSCL 20C

A comparative review of the principles of ion thruster and chemical rocket operations is presented. The 30cm mercury ion thruster development and the specifications imposed on it by the Solar Electric propulsion System program are discussed. The 30cm thruster operating range, efficiency, wear out lifetime, and interface requirements are described. T.M.

N81-13080# Control Dynamics Co., Huntsville, Ala.
APPLICATION OF DISCRETE GUIDANCE AND CONTROL THEORY TO FUTURE ARMY MODULAR MISSILES Final Technical Report
S. M. Seltzer 30 Sep. 1980 123 p refs
(Contract DAAK40-79-C-0213)
(AD-A091273) Avail: NTIS HC A06/MF A01 CSCL 17/7

This technical report covers the Control Dynamics Company's efforts performed in completing the requirements set forth in Technical Requirement No. T-0208, entitled, 'Application of Digital Technology to Guidance and Control Theory.' Described is a simple analytical set of tools developed to help the practicing control system design engineer. These tools are the Parameter Space technique and the Cross-Multiplication technique. Also described is a comprehensive Digital Design seminar conducted for selected members of the Guidance and Control Directorate. Application of advanced digital theory to the PERSHING II digital autopilot is described, as well as the beginning efforts to evaluate the consequences of microprocessor implementation of digital filters. GRA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N81-13081*# Engineering Analysis, Inc., Huntsville, Ala.
SPACE SHUTTLE SIMULATION MODEL Summary Report
Frank B. Tatom and S. Ray Smith 17 Nov. 1980 78 p refs
(Contract NAS8-33818)
(NASA-CR-161618; EAI-TR-80-003A) Avail: NTIS HC A05/MF A01 CSCL 22B

The effects of atmospheric turbulence in both horizontal and near horizontal flight, during the return of the space shuttle, are important for determining design, control, and 'pilot-in-the-loop' effects. A nonrecursive model (based on von Karman spectra) for atmospheric turbulence along the flight path of the shuttle orbiter was developed which provides for simulation of instantaneous vertical and horizontal gusts at the vehicle center-of-gravity, and also for simulation of instantaneous gust gradients. Based on this model, the time series for both gusts and gust gradients were generated and stored on a series of magnetic tapes which are entitled shuttle simulation turbulence tapes (SSTT). The time series are designed to represent atmospheric turbulence from ground level to an altitude of 10,000 meters. The turbulence generation procedure is described as well as the results of validating the simulated turbulence. Conclusions and recommendations are presented and references cited. The tabulated one dimensional von Karman spectra and the results of spectral and statistical analyses of the SSTT are contained in the appendix. A.R.H.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N81-13215*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DIFFERENTIAL VERY LONG BASELINE INTERFEROMETRY (DELTA VLBI) SPACECRAFT TRACKING SYSTEM DEMONSTRATION. PART 2: DATA ACQUISITION AND PROCESSING
C. S. Christensen, B. Moultrie, P. S. Callahan, F. F. Donivan, and S. C. Wu *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 60-67 refs (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics.*

N81-13082*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DECOUPLED CONTROL OF A LONG FLEXIBLE BEAM IN ORBIT
Harold A. Hamer and Katherine G. Johnson Dec. 1980 77 p refs

(NASA-TP-1740; L-13726) Avail: NTIS HC A05/MF A01 CSCL 22B

Control involved commanding changes in pitch attitude as well as nulling initial disturbances in the pitch and flexible modes. Control force requirements were analyzed. Also, the effects of parameter uncertainties on the decoupling process were analyzed and were found to be small. Two methods were investigated: the system was completely coupled and certain actuators were then eliminated, one by one, which resulted in some or all modes not fully controlled; specified modes of the system were excluded from the decoupling control law by employing vewer control actuators than modes in the model. In both methods, adjustments were made in the feedback gains to include the uncontrolled modes in the overall control of the system. Author

N81-13083# TRW Defense and Space Systems Group, Redondo Beach, Calif.

PULSED PLASMA PROPULSION SYSTEM/SPACECRAFT DESIGN GUIDE Final Report, Aug. 1978 - Jun. 1980

M. N. Huberman and S. Zafran Edwards AFB, Calif. AFRPL Sep. 1980 98 p refs

(Contract F04611-78-C-0064; AF Proj. 3058)

(AD-A091006; AFRPL-TR-80-38) Avail: NTIS HC A05/MF A01 CSCL 21/3

The purpose of this publication is to describe the characteristics of the millipound pulsed plasma propulsion system as an aid to potential spacecraft designers and users of electric propulsion. It contains performance and interface data, design constraints, and various other considerations applicable to the implementation of the pulsed plasma propulsion system. GRA

N81-13084# Science Applications, Inc., El Segundo, Calif.

SPACECRAFT CHARGING MODEL VALIDATION/TEST EVALUATION

Edward E. ODonnell 11 Sep. 1980 30 p refs

(Contract F04701-80-C-0009)

(AD-A091226; CDRL-A009) Avail: NTIS HC A03/MF A01 CSCL 22/2

One of the primary objectives of the cooperative NASA/Air Force Spacecraft Charging Investigation is to ensure that validated analytical models and test techniques are available for the assessment of spacecraft interactions with the space environment. Models must be capable of predicting the degradation (permanent damage or anomalous behavior) of spacecraft due to the environment. Also, test techniques must be developed for the purposes of providing input data for the models, or for certifying that the spacecraft fulfills its design requirements. This report is an update to the Model Validation/Test Evaluation Status Report (CDRL 006A2) submitted August 1979 by SAI. In the past year, p78-2 data have been integrated into an environmental Atlas. NASCAP predictions have been compared with the P78-2 SSPM sample measurements. Two major electron spraying experiments have been conducted on geometric spacecraft models for which coupling predictions have been made. A quasi-static model of the SGEMP code SABER has been developed and exercised, and significant work has been reported on the emission of current during discharges. GRA

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N81-13085 Purdue Univ., Lafayette, Ind.

UNSTEADY THREE-DIMENSIONAL SUBSONIC FLOW IN A SOLID PROPELLANT ROCKET MOTOR INCLUDING THE EFFECT OF MOTOR ROTATION Ph.D. Thesis

Jeffrey Jonathan Brown 1980 311 p

Avail: Univ. Microfilms Order No. 8027259

A mathematical analysis and a computer program based upon that analysis are presented for calculating the effects of high rotation rates on the subsonic flow field in a solid propellant rocket motor. The geometry of the propellant grain and propulsive nozzle was assumed to be axisymmetric. The flow field was three dimensional due to the effects of the motor rotation. The governing equations for unsteady three dimensional flow were derived in a noninertial reference frame attached to the missile for the most general case where the missile has both angular velocity and acceleration, as well as linear acceleration all with respect to Earth. Inviscid flow of a thermally and calorically perfect gas was considered. The solid propellant burning rate law is the well known pressure exponent empirical correlation including erosive burning. The resulting equations were integrated numerically using the variation of the method of characteristics due to Kentzer. The numerical integration procedure and a production type computer program for implementing the procedure are presented. Dissert. Abstr.

N81-13086*# Battelle Columbus Labs., Ohio.

EVALUATION OF AXIAL LOCK-UP OF SPACE SHUTTLE MAIN ENGINE BEARINGS FROM HIGH PRESSURE OXYGEN TURBOPUMP Final Report

J. W. Kannel and K. F. Dufrane 24 Nov. 1980 29 p refs

(Contract NAS8-33576)

(NASA-CR-161613) Avail: NTIS HC A03/MF A01 CSCL 21H

The mainshaft support bearings of long life turbopumps for use on the space shuttle were evaluated to determine possible causes of failure. Specific aspects examined include the sensitivity of 15 degree versus 25 degree contact angle bearings with regard to heat damage and thermal runaway, the L/D aspects of the turbine end bearing pair with regard to hang-up due to cocking, the hang-up required to support a 44.5 KN axial load without cartridge slipping, the outer race growth as a result of a 44.5 KN axial load, and bearing torque as a function of axial load. Results indicate that hang-up of the cartridge due to bearing heating is a serious problem especially if poor lubrication of the bearing occurs and that race growth due to axial load can contribute to cartridge lock-up. The experimental evaluation of bearing performance under axial loads indicates that the bearing torque is a strong function of surface lubrication. J.M.S.

N81-13087*# Wyle Labs., Inc., Huntsville, Ala. Scientific Services and Systems Group.

EVALUATION OF SPACE SHUTTLE MAIN ENGINE FLUID DYNAMIC FREQUENCY RESPONSE CHARACTERISTICS

T. G. Gardner Oct. 1980 144 p refs

(Contract NAS8-33508)

(NASA-CR-161614; Wyle-TM-80-8) Avail: NTIS HC A07/MF A01 CSCL 21H

In order to determine the POGO stability characteristics of the space shuttle main engine liquid oxygen (LOX) system, the fluid dynamic frequency response functions between elements in the SSME LOX system was evaluated, both analytically and experimentally. For the experimental data evaluation, a software package was written for the Hewlett-Packard 5451C Fourier analyzer. The POGO analysis software is documented and consists of five separate segments. Each segment is stored on the 5451C disc as an individual program and performs its own unique function. Two separate data reduction methods, a signal calibration, coherence or pulser signal based frequency response function

blanking, and automatic plotting features are included in the program. The 5451C allows variable parameter transfer from program to program. This feature is used to advantage and requires only minimal user interface during the data reduction process. Experimental results are included and compared with the analytical predictions in order to adjust the general model and arrive at a realistic simulation of the POGO characteristics. A.R.H.

N81-13088# Aerojet Liquid Rocket Co., Sacramento, Calif.
LOW-THRUST BIPROPELLANT ENGINE TECHNOLOGY Final Technical Report, Sep. 1977 - Jul. 1980
L. Schoenman and R. L. Friedman Aug. 1980 428 p
(Contract F04611-77-C-0053; AF Proj. 3058)
(AD-A091078; AFRPL-TR-80-47) Avail: NTIS HC A19/MF A01 CSCL 21/9

The design, fabrication and hotfire test of a low-thrust, 0.5 lbF class bipropellant rocket engine, capable of providing very small, precisely repeatable impulse bits and long, high performance, steady state burns, was undertaken in a three phase program. Phase I, Analysis and Design, consisted of detailed studies and tradeoff analyses of general mission/system requirements versus engine assembly parametrics and the development of the overall design approach. Phase II, Design Verification, consisted of component (valve, injector and chamber) fabrication and development testing for the demonstration point design. Phase III, Demonstration, consisted of engine fabrication and demonstration of the point design. While a 100% achievement of all contract goals was elusive within the resources provided, significant advancements in small engine technology were made that prove the feasibility of developing a 0.5 lbF class bipropellant engine. Steady state durability of 8 hours of firing without failure has been demonstrated, along with a small impulse bit of less than 0.005 + or - .0005 lbF sec. It is reasonable to predict that the same engine that ran 8 hours steady state will be able to accomplish the 10 hour life goal based on its excellent postfire condition. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

No abstracts in this category.

24 COMPOSITE MATERIALS

Includes laminates.

N81-13089 Drexel Univ., Philadelphia, Pa.
AN INVESTIGATION ON THE STRENGTH-LIFE BEHAVIOR OF A UNDIRECTIONAL GRAPHITE/EPOXY COMPOSITE Ph.D. Thesis
James Mark Alper 1981 142 p
Avail: Univ. Microfilms Order No. 8022847

Static strength tests, fatigue life tests, proof load tests, residual strength tests (tension and compression), and cumulative damage tests were conducted, each with a large number of specimens in order to make statistical conclusions. The test data were analyzed by means of the Weibull distribution with the maximum likelihood method for parameter estimation. Results from these studies show that the proof load procedure can be used to screen out weaker specimens and guarantee a minimum static strength: similarly, this procedure can also assure a minimum fatigue life. These results also verify the concept of equal rank between static strengths and fatigue life. This latter concept is the basis for most existing fatigue degradation analyses that are statistical in nature. The residual strength results show the effects of tensile fatigue on both the tensile residual strength and the compressive residual strength of the unidirectional composite. Dissert. Abstr.

N81-13090 Notre Dame Univ., Ind.
PERCOLATION AND CONDUCTIVITY IN UNIDIRECTIONAL FIBER COMPOSITE MATERIALS Ph.D. Thesis
Thomas Joy 1980 142 p
Avail: Univ. Microfilms Order No. 8028462

Extensions of percolation theory to treat transport in unidirectional fiber composite materials of finite depth are described. Square and triangular models are applied to the composite system and it is found that the critical concentration of the conducting phase decreases with decreasing thickness of the material. An effective medium theory, which applied to thick systems, is derived for the triangular model. Numerical results are presented for the lattice conductivity on both models, and the asymptotic values compared with effective medium theory. Close agreement is found except near the critical concentration. Finally the predicted theoretical conductivity curves are compared with experimental measurements. The average fiber center to fiber conductance obtained from the comparison is explained on the basis of materials properties. Dissert. Abstr.

N81-13091*# Hercules, Inc., Wilmington, Del.
GRAPHITE FIBER SURFACE TREATMENT TO IMPROVE CHAR RETENTION AND INCREASE FIBER CLUMPING Final Report
J. T. Paul, Jr. and W. E. Weldy Nov. 1980 33 p refs
(Contract NAS1-15869)
(NASA-CR-159357) Avail: NTIS HC A03/MF A01 CSCL 11D

Composites containing carbon and graphite fibers can release fibers into the atmosphere during a fire. This release can potentially cause failure in some types of electrical equipment. Reduced fiber dispersion during and after combustion will reduce risks. Epoxidized char forming systems were synthesized which will react with commercially available surface treated carbon fiber. Fibers modified with these char formers retained adhesion in a specific epoxy matrix resin. Small scale combustion testing indicates that using these char former modified fibers in laminates will help to reduce the dispersement of fibers resulting from exposure to fire without sacrificing resin to fiber adhesion. Author

N81-13092# Notre Dame Univ., Ind. Dept. of Electrical Engineering.
MODELING AND MODIFICATION OF THE ELECTROMAGNETIC PROPERTIES OF ADVANCED COMPOSITE MATERIALS Final Report
W. J. Gajda, Jr., P. K. Ajmera, W. C. Strieder, Richard Kwor, C. Araujo, T. Joy, and L. Scruggs 1980 153 p refs
(Grant AF-AFOSR-3453-77)
(AD-A091025; AFOSR-80-1071TR) Avail: NTIS HC A08/MF A01 CSCL 11/4

The electromagnetic hazards involved in using composite materials in aircraft are considered. Attention is focused on the problems associated with the lower conductivities of composites in comparison to those of metals. The concept of a high conductivity composite is advanced as a solution to the electromagnetic problems associated with presently available composites. The electrical properties of available advanced composite materials, primarily graphite/epoxy and boron/epoxy, are presented. Basic deterministic models relating the electrical conductivities (DC to 50 MHz) of composites to the fiber conductivity, the matrix conductivity and the volume fraction of the fibers are developed. The electrical behavior of as manufactured graphite and boron fibers is also detailed. The possibility of 'doping' fibers with suitable impurities to increase conductivity without an associated decrease in specific strength is explored. Boron fibers undergo a recrystallization when heated above 800 C and have, as a consequence, significantly reduced strengths. Since thermal diffusion of impurities requires temperatures above 800 C, significant effort was devoted to inhibiting this recrystallization. Diffusion of nickel impurities inhibited this process and resulted in increased conductivities. GRA

N81-13093# General Dynamics/Fort Worth, Tex.
TIME-DEPENDENT ENVIRONMENTAL BEHAVIOR OF GRAPHITE/EPOXY COMPOSITES Final Technical Report, 1 Aug. 1977 - 31 Jan. 1980
K. G. Kibler May 1980 151 p refs

(Contract F33615-77-C-5109; AF Proj. 2419)
(AD-A091028; AFWAL-TR-80-4052) Avail: NTIS HC A08/MF A01 CSCL 11/4

Experimental and analytical investigations have been conducted to determine the individual and combined effects of temperature and absorbed moisture on the time dependent mechanical response of unidirectional and cross-plied graphite epoxy composite. Tensile creep response was measured at room temperature and four elevated temperatures (up to the glass transition region of the materials) for dry specimens and for specimens moisture saturated at 75% and 95% relative humidity. Results were obtained for two material systems: Narmco T300-5208 and Hercules AS/3502. The stress levels used were demonstrated to be within the range of linear viscoelastic response. Superposition techniques were used to determine compliance master curves from the results for individual temperature and moisture condition, and quasi-elastic conversion was employed to extract relaxation modules behavior. Expansional strains due to temperature and moisture were measured. From measured principal properties, laminate response was predicted using time stepped elastic analyses for the environments considered. Analytical procedures for transient and nonuniform temperature and moisture conditions were formulated. An analytical method for minimizing residual stresses during cure was developed, and sample results for the present materials are presented. Observations and recommended resulting from these investigations are included in this final report. GRA

N81-13094# Sandia Labs., Albuquerque, N. Mex.
ROOM-TEMPERATURE TRANSVERSE COMPRESSIVE CREEP OF THICK KEVLAR FABRIC/EPOXY LAMINATES
R. H. Ericksen 1980 20 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-0104C) Avail: NTIS HC A02/MF A01

Cylindrical samples with void contents of 4 and 14 percent were tested along with those of unreinforced resin. The composites exhibited logarithmic creep. Creep rates were 2 times higher over the entire stress range for the high porosity composites. At a stress of 87 MPa the resin creep curve was similar to that of the composites. At higher stresses, the resin crept faster and exhibited more strain. It is proposed that axial compressive creep of the cylindrical composite specimens is governed by Poisson induced strains leading to tensile loading of the reinforcing fibers. Axial initial strain and creep rate data for the composite were converted to radial data using measured values of Poisson ratio. These values of composite specimen radial creep rate were in good agreement with tensile creep data of Kevlar 49 fibers. Author

N81-13095# Mound Lab., Miamisburg, Ohio.
Al/Cu2O THERMITE COMPATIBILITY STUDIES BY X-RAY PHOTOELECTRON AND X-RAY INDUCED AUGER SPECTROSCOPY
P. S. Wang, L. D. Haws, W. E. Moddeman, and A. Rengan (Dayton Univ., Ohio) 1980 12 p refs Presented at ADPA Compatibility Meeting, Blacksburg, Va., 13 Oct. 1980
(Contract DE-AC04-76DP-00053)
(MLM-2765-OP; CONF-801048-2) Avail: NTIS HC A02/MF A01

Using X-ray photoelectron spectroscopy (XPS) and with X-ray induced Auger spectroscopy (XAES), the kinetic energies of the signals were observed for Al 1s, Cu 2p/sub 1/2/, Cu 2p/sub 3/2/, Cu-L3-MM, O 1s, Al K-LL, C 1s and Cu 3s. The Al2O3 film thicknesses on Al metal surfaces were deduced from signal intensity ratios of Al(3+) and Al in XPS of Al2s and from AlK-LL XAES signals. The oxide thicknesses on Al powders from the manufacturer were measured. Mixing Al with Cu2O at room temperature, to form the thermitic composition, induced oxidation of the Al and increased the oxide film thickness. Hot pressing of thermite powders at 425 C to form pellets was found to double the oxide layer. This oxide layer was found to protect the Al fuel; futher aging of these pellets at 180 C for several months showed a negligible change in composition and thickness of the surface oxide. The bulk of the pellet was found to be stable and of good quality. Author

N81-13096# California Univ., Livermore. Lawrence Livermore Lab.
CONTINUOUS MIXING AND APPLICATION FOR WET WINDING FIBER COMPOSITES
R. J. Sanchez and R. J. Sherry 12 Aug. 1980 18 p refs
(Contract W-7405-eng-48)
(UCID-18765) Avail: NTIS HC A02/MF A01

A method is described for mixing and applying matrix during fiber composite winding. The method allows precise control of the fiber-matrix ratio and easy adjustment of the ratio at any time. DOE

N81-13097# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
TOUGHENING OF ZIRCONIA COMPOSITES .M.S. Thesis
Nicholas Hamilton Burlingame Jun. 1980 98 p refs
(Contract W-7405-eng-48)
(LBL-10787) Avail: NTIS HC A05/MF A01

The addition of a zirconium dioxide dispersion can signficantly enhance the toughness of a ceramic material. The toughness improvement is due to a stress reduction at the tip of a propagating crack which is the result of a preferential martensitic transformation of ZrO2 particles in the stress field of the crack. From thermodynamic considerations and experimental observations the toughening effect is shown to be strongly dependent on the ZrO2 particle size. The effect of variations in temperature, composition and matrix materials are demonstrated, and analyzed in respect to the resultant deviations in the particle size toughening effect. DOE

N81-13098# Sandia Labs., Albuquerque, N. Mex.
HYDROGEN IN AMORPHOUS SILICON
P. S. Peercy 1980 43 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-1109C; CONF-800744-2) Avail: NTIS HC A03/MF A01

The structural aspects of amorphous silicon and the role of hydrogen in this structure are reviewed with emphasis on ion implantation studies. In amorphous silicon produced by Si ion implantation of crystalline silicon, the material reconstructs into a metastable amorphous structure which has optical and electrical properties qualitatively similar to the corresponding properties in high purity evaporated amorphous silicon. Larger hydrogen concentrations can be achieved under certain conditions, but the excess hydrogen may be attributed to defects and voids in the material. Glow discharge or sputter deposited amorphous silicon has more desirable electrical and optical properties when the material is prepared with low hydrogen concentration and monohydride bonding. Results of structural studies and hydrogen incorporation in amorphous silicon are discussed relative to the different models proposed for amorphous silicon. S.F.

N81-13099# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
METHODS FOR CALCULATION OF LAMINATE STIFFNESS AND STRENGTH ON MAGNETIC CARD CALCULATOR TYPE HP-97, 67, 41C
Christer Lundemo Mar. 1980 54 p refs
(Contract FMV-F-FL-82223-78-170-21-001)
(FFA-TN-HU-2193) Avail: NTIS HC A04/MF A01

Programs for computing laminate strength and stiffness were coded on a HP-97 calculator, for checking stiffness, stresses, strains and strength of any plane symmetric composite laminate. Classical laminate theory, and the standard coordinate system were used. A card for calculation of moisture absorption in composite laminates is included. Author (ESA)

N81-13100# Scientific Service, Inc., Redwood City, Calif.
FIRE TESTS OF AUTOMOTIVE GRADE CARBON FIBER COMPOSITES Final Report, Mar. - Jan. 1979
C. Wilton, J. Boyse, and J. Zaccor Jun. 1980 64 p refs Sponsored in part by DOT
(PB80-221690; DOT-TSC-RSPA-80-11) Avail: NTIS HC A04/MF A01 CSCL 13F

Selected composite materials containing carbon fibers that are planned for use, or that have a high potential for use, in automobiles and other vehicles were subjected to fire tests to determine the quantity and distribution of carbon fibers released during exposure of the composites to fires. The test data indicate that automobile fires, per se, are unlikely to be the cause of

serious risk from single fiber release; however, the possibility of automobile fires occurring in combination with other factors, such as wind and fire fighting, rescue, and disposal operations could result in additional fiber release. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N81-13101 Purdue Univ., Lafayette, Ind.
ANALYSIS OF ORGANIC COMPOUNDS USING SECONDARY ION MASS SPECTROMETRY, 1. ENERGY PARTITIONING IN UNIMOLECULAR IONIC DISSOCIATIONS, 2 Ph.D. Thesis
Robert Jeffrey Day 1980 216 p
Avail: Univ. Microfilms Order No. 8027272

This research focused on two areas of interest in mass spectrometry. While investigating the ionization of organic compounds in secondary ion mass spectrometry (SIMS) three distinct mechanisms of ionization were uncovered, cationization, electron transfer and direct sputtering. The second field of study explored the use of molecular orbital calculations in elucidating those factors that favor kinetic energy release in unimolecular ionic dissociations. Cationization was shown to be a general process, one that occurs with a wide variety of both metals and organic compounds. Cationized molecules are suggested to form by ion/molecule reactions between desorbed neutral molecules and sputtered metal ions. Ionization by electron transfer was observed to dominate the SIMS spectra of polycyclic aromatic hydrocarbons. Ion bombardment of these materials resulted in the emission of radical cations, which may be formed under bombardment by secondary electrons also emitted during sputtering. The semi-empirical molecular orbital method was used to calculate reaction paths and transition state geometries for hydrogen eliminations from several cations and water loss from protonated methanol. Dissert. Abstr.

N81-13102 Purdue Univ., Lafayette, Ind.
EVALUATION OF LIQUID CHROMATOGRAPHY WITH THIN-LAYER AMPEROMETRIC DETECTION FOR THE DETERMINATION OF TYROSINE METABOLITES OF CLINICAL AND BIOCHEMICAL SIGNIFICANCE Ph.D. Thesis
Craig S. Bruntlett 1980 209 p
Avail: Univ. Microfilms Order No. 8027260

Electrochemical detection for liquid chromatography (LCEC) has been shown to be a very versatile tool for biochemical analysis. The principles and operational aspects of the thin layer amperometric detector are discussed. The LCEC technique was used to determine important tyrosine metabolites from urine, serum, and brain tissue samples. A method is described for determining homogentisic acid (HGA) in urine and serum. The minimum detectable quantity was 0.1 micro g/ml. Acidic and neutral metabolites of the tyrosine catecholamine biochemical pathway were determined in urine and brain tissue samples. 3,4 Dihydroxyphenylacetic acid (DOPAC) was determined by a procedure taking advantage of the selective adsorption of cis-diol compounds on alumina at high pH. DOPAC was desorbed from the alumina and quantitated using LCEC. A chromatogram requiring less than 15 minutes was obtained using this procedure. Dissert. Abstr.

N81-13103 State Univ. of New York at Buffalo.
HIGH PERFORMANCE LIQUID CHROMATOGRAPHY USING METAL-SOLUTE COMPLEXES Ph.D. Thesis
Francis Kin-Man Chow 1980 192 p
Avail: Univ. Microfilms Order No. 8027594

The use of metal-solute complexation was studied extensively using three approaches: (1) to originate and develop novel selective metal ion bonded phases using both innersphere and outersphere coordination modes, (2) to modify the mobile phase chemistry so that metal-solute interaction can be used advantageously, and (3) to develop an empirical retention mechanism to account for some of the retention behaviours observed in this work and to correlate the capacity ratio to complex formation constant. In the first approach a series of chelating moieties such as propylamine, dithiocarbamate, diketone were chemically bonded to silica matrix. Metal ions such as Cu(II) and Co(III) were coordinated to them. Solutes were separated according to their extent of interaction with the bonded metal. In the second approach, metal ions such as Cu(II), Mg(II) and Ag(I) were added to the mobile phases to compete with the stationary phase metal, so that the kinetics of adsorption and desorption of the sample solutes can be improved. In the third approach, an empirical retention mechanism was proposed and a working equation was derived to correlate capacity ratio to complex formation constant. Dissert. Abstr.

N81-13104*# State Univ. of New York at Stony Brook.
COMBUSTION AT REDUCED GRAVITATIONAL CONDITIONS
A. L. Berlad, L. S. Wang, N. Joshi, and C. I. Pai [1980] 41 p refs
(Grant NsG-3051)
(NASA-CR-163812) Avail: NTIS HC A03/MF A01 CSCL 21B

The theoretical structures needed for the predictive analyses and interpretations for flame propagation and extinction for clouds of porous particulates are presented. Related combustion theories of significance to reduced gravitational studies of combustible media are presented. Nonadiabatic boundaries are required for both autoignition theory and for extinction theory. Processes that were considered include, pyrolysis and vaporization of particulates, heterogeneous and homogeneous chemical kinetics, molecular transport of heat and mass, radiative coupling of the medium to its environment, and radiative coupling among particles and volume elements of the combustible medium. Author

N81-13105*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IMPROVEMENT AND SCALE-UP OF THE NASA REDOX STORAGE SYSTEM
Margaret A. Reid and Lawrence H. Thaller 1980 9 p refs Presented at 15th Intersoc. Energy Conversion Engineering Conf., Seattle, 18-21 Aug. 1980
(Contract DE-AI04-80AL-12726)
(NASA-TM-81632; DOE/NASA/12726-6; E-644) Avail: NTIS HC A02/MF A01 CSCL 10C

A preprototype 1.0 kW redox system (2 kW peak) with 11 kWh storage capacity was built and integrated with the NASA/DOE photovoltaic test facility at NASA Lewis. This full function redox system includes four substacks of 39 cells each (1/3 cu ft active area) which are connected hydraulically in parallel and electrically in series. An open circuit voltage cell and a set of rebalance cells are used to continuously monitor the system state of charge and automatically maintain the anode and cathode reactants electrochemically in balance. Recent membrane and electrode advances are summarized and the results of multicell stack tests of 1 cu ft are described. R.C.T.

N81-13106*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ACCURACY OF TRACE ELEMENT DETERMINATIONS IN ALTERNATE FUELS
Leslie A. Greenbauer-Seng 28 May 1980 22 p refs Presented at May Conf. of the Soc. of Appl. Spectry. of Cleveland and the Am. Chem. Soc. Anal. Topics Group of Cleveland, Ohio, 28 May 1980
(NASA-TM-81609; E-605) Avail: NTIS HC A02/MF A01 CSCL 07D

A review of the techniques used at Lewis Research Center (LeRC) in trace metals analysis is presented, including the results of Atomic Absorption Spectrometry and DC Arc Emission Spectrometry of blank levels and recovery experiments for several metals. The design of an Interlaboratory Study conducted by LeRC is presented. Several factors were investigated, including: laboratory, analytical technique, fuel type, concentration, and ashing additive. Conclusions drawn from the statistical analysis

will help direct research efforts toward those areas most responsible for the poor interlaboratory analytical results. Author

N81-13107# Rochester Univ., N. Y. Dept. of Chemistry.
THE ELECTROCATALYTIC REDUCTION OF CARBON DIOXIDE USING MACROCYCLES OF NICKEL AND COBALT
Barbara J. Fisher and Richard Eisenberg 24 Oct. 1980 11 p refs Submitted for publication
(Contract N00014-80-C-0525; Grant NSF CHE-79-10390; NR Proj. 053-742)
(AD-A091344; TR-1) Avail: NTIS HC A02/MF A01 CSCL 07/4

Carbon dioxide has been activated towards reduction by electrochemically primed transition metal complexes. This indirect reduction allows more favorable electrode potentials than those required when CO2 is reduced directly. The metal complexes employed were Curtis type tetraazamacrocyclic complexes of nickel and cobalt. The electrode potentials ranged from -1.3v to -1.6v vs SCE. Evidence for CO2 reduction was obtained from controlled potential coulometry experiments performed in a gas tight electrolysis cell followed by g.c. analysis. The solvents used were either CH3CN-H2O or water only. Carbon monoxide was found to comprise at least 50% of the total reduced products in all cases; H2 was also produced in most cases. While a protic source was found to be necessary for CO2 reduction to occur, the results show that CO2 competes effectively with H- for the electrons available from the electrochemically reduced metal complexes. In addition, the reduction was found to be electrocatalytic, with current efficiencies for total reduced products as high as 98%. GRA

N81-13108# Indiana Univ., Bloomington. Dept. of Chemistry.
EFFECTS OF GAS COMPOSITION AND FLAME SHEATHING ON THE SPATIAL VELOCITY PROFILES OF LAMINAR ANALYTICAL ACETYLENE FLAMES
R. E. Russo and G. M. Hieftje 2 Oct. 1980 32 p refs
(Contract N00014-76-C-0838)
(AD-A091386; TR-29) Avail: NTIS HC A03/MF A01 CSCL 20/2

A recently developed technique has been employed to map the spatial rise velocity profiles (horizontal and vertical) of commonly used laminar analytical flames and to determine the influence on the profiles of fuel-to-oxidant ratio and the presence of a flame sheath. The rise velocities for fuel-rich, lean, and stoichiometric flames were found to differ substantially, the entire profile being greatest for the fuel-rich condition and lowest for the fuel-lean flame. In addition, the change in rise velocity with the addition of a solid (quartz tube) or gas (N2) sheath was studied. The following sheath, at several different flow rates, affected each rise velocity profile principally by altering atmospheric entrainment and thereby changing secondary combustion in the flame. In contrast, a solid quartz tube used as a sheath produces an additional increase in the entire velocity profile of each flame, since it constrains gas expansion to the direction of flame propagation. The degree to which the velocity of each flame is affected by a sheath is strongly influenced by fuel-to-oxidant ratio. GRA

N81-13109# Army Armament Research and Development Command, Aberdeen Proving Ground, Md.
BRLGRAY: THE BALLISTIC RESEARCH LABORATORY VERSION OF THE GRAY EQUATION OF STATE
Joseph F. Lacetera Aug. 1980 36 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A091246; AD-E430515; ARBRL-TR-02258) Avail: NTIS HC A03/MF A01 CSCL 20/13

The BRLGRAY EOS is described. EOS input parameters and mixed-phase boundaries are shown for Al, Cu, and Fe. Comparisons are shown with Tillotson and HULL EOSIS. GRA

N81-13110# Fairchild Camera and Instrument Corp., Palo Alto, Calif. Research and Development Lab.
PROCESS VARIABLE DEPENDENCE AND INTER-RELATIONSHIP BETWEEN AVALANCHE INJECTED AND RADIATION INDUCED CARRIER TRAPPING IN THERMAL OXIDES Final Technical Report, 1 Apr. 1979 - 31 Mar. 1980
B. E. Deal and R. R. Razouk Jul. 1980 53 p refs
(Contract N00014-79-C-0297)
(AD-A091299) Avail: NTIS HC A04/MF A01 CSCL 07/4

Characterization of the process dependence of avalanche injected electrons and holes in thermally grown silicon dioxide has been carried out. Process parameters investigated include oxidation temperature (900, 1000 and 1100 deg C), oxidation ambient (O2, H2O, and O2/HCl), post-oxidation in situ anneal ambient (N2, Ar), cooling ambient (O2, N2, Ar, and H2O), cooling rates (less than 3 sec, 2 min, and 10 min), and post-metallization anneal ambients (N2, N2/H2). Results indicate basic differences between the process dependence of electron traps and that of hole traps while excellent agreement is obtained between avalanche injected and radiation induced hole trapping. Characteristics of the process dependence of hole traps are: a minimum for dry O2 oxides, an increase for N2 post oxidation anneals at 1000 deg C and above, and a high density for HCl/O2 and steam grown oxides. Electron trap densities are minimum at 1100 deg C and highest for steam grown oxides although post oxidation anneals at 1000 deg C are effective in their reduction. Post-metallization anneal ambients were found to have little or no effect on the measured trapping of both holes and electrons. GRA

N81-13111# Drexel Univ., Philadelphia, Pa. Dept. of Chemistry.
INFRARED EMISSION BY AN AEROSOL CLOUD Final Report, 1 Jul. 1978 - 30 Jun. 1980
Raymond A. Mackay 10 Oct. 1980 24 p
(Contract DAAG29-79-C-0068; Grant DAAG29-78-G-0117)
(AD-A091295; ARO-16065.1-C) Avail: NTIS HC A02/MF A01 CSCL 07/4

The present study was designed to produce infrared emission by means of exothermic reaction between a gas and a liquid aerosol. We have examined a number of gas aerosol systems employing acid-base reactions, and have observed significant levels of radiation from the reaction of chlorosulfonic acid aerosol with gaseous ammonia and water. Other systems, including sulfuric acid ammonia, octanoic acid ammonia and octylamine hydrogen chloride, have produced detectable levels of radiation. Some methods for the investigation of emission from gas aerosol reactions have been explored, and the results of these studies utilizing a chlorosulfonic aerosol system are presented. GRA

N81-13112# EIC, Inc., Newton, Mass.
NONAQUEOUS ELECTROCHEMICAL PHOTOVOLTAIC CELLS BASED ON N-GaAs AND N-Si
Margaret E. Langmuir, Ronald H. Micheels, and R. David Rauh 1980 10 p refs Presented at the 3rd Intern. Conf. on Photochem. Conversion and Storage of Solar Energy, Boulder Colo., 3-8 Aug. 1980
(Contract N00014-79-C-0700)
(AD-A091382; TR-1) Avail: NTIS HC A02/MF A01 CSCL 07/4

The photoelectrochemical properties of n-GaAs and n-Si are compared in nonaqueous electrolytes. Si is the more sensitive material to surface treatment, and is more prone to anodic passivation. Surface adsorption of Ru or basic heterocyclic polymers greatly improves photocurrent yields for both materials, possibly due to a complexation of surface states. GRA

N81-13113# Washington Univ., Seattle. Dept. of Chemistry.
TRANSIENTS IN THERMAL ISOMERIZATION OF CYCLOBUTENE BY THE VARIABLE ENCOUNTER METHOD. VIBRATIONAL ENERGY TRANSFER AND RELAXATION AT LOWER TEMPERATURES
F. C. Wolters, M. C. Flowers, and B. S. Rabinovitch 15 Oct. 1980 18 p refs
(Contract N00014-75-C-0690; NR Proj. 092-549)
(AD-A091377; NR092-549-TR-18) Avail: NTIS HC A02/MF A01 CSCL 07/3

AN investigation of transients in cyclobutene vibrational relaxation by the VEM method has been made. Temperatures in the region 429 K to 778 K were used. Cyclobutene molecules isomerize to butadiene when transported above the critical threshold E sub 0. The collision efficiency of the wall increases with lowering of temperature, and strong collider behavior is obtained below 450 K. The data are described by a Gaussian

form of the collisional transition probability function. An exponential form of the probability function cannot fit all of the data.
GRA

N81-13114# Army Electronics Research and Development Command, Fort Monmouth, N. J. Electronics Technology/Devices Lab.
ELECTROCHEMICAL REDUCTION OF SULFURYL CHLORIDE IN SOLUTIONS CONTAINING LITHIUM TETRACHLOROLUMINATE
Wishvender K. Behl Sep. 1980 19 p refs
(Contract DA-1L1-61102-AH-47)
(AD-A090921; DELET-TR-80-17) Avail: NTIS HC A02/MF A01 CSCL 07/4

The electrochemical reduction and oxidation of sulfuryl chloride in 1 molar LiAlCl4-So2Cl2 solutions were studied at glassy carbon electrodes using the technique of cyclic voltammetry. It was found that the reduction of chlorine, which is formed by the decomposition of sulfuryl chloride, precedes and obscures the reduction of sulfuryl chloride. Thus, in chloride rich solutions, sulfuryl chloride reduction peak in the cyclic voltammograms is completely masked by the chlorine reduction peak. However, in solutions saturated with sulfur dioxide, the chlorine reduction peak is relatively smaller than the sulfuryl chloride reduction peak. The reduction of both chlorine and sulfuryl chloride leads to the deposition of insoluble lithium chloride at the electrode surface and results in its passivation. The electrochemical oxidation of LiAlCl4-SO2Cl2 solutions leads to the formation of chloride, first by the oxidation of AlCl4(-) ions followed by the oxidation of sulfuryl chloride. GRA

N81-13115# School of Aerospace Medicine, Brooks AFB, Tex.
RECOVERY OF VOLATILE ORGANICS FROM SORBENT TUBE SAMPLING SYSTEMS Progress Report, Jan. 1978 - Nov. 1979
William W. Lackey, Charles L. Martin, James P. Conkle, and Richard L. Miller Aug. 1980 15 p refs
(AF Proj. 7930)
(AD-A090954; SAM-TR-80-22) Avail: NTIS HC A02/MF A01 CSCL 07/4

Comparative data are presented on the recovery of organic compounds (vapors) from solid sorbent (tenax-GC) sampling tubes by thermal desorption of the tube contents (a) directly onto a packed gas chromatographic column, vs. (b) onto an unpacked precolumn loop for subsequent injection into the gas chromatography. Twenty to eighty percent increases in flame ionization detector (FID) response were obtained for a limited selection of compounds which were desorbed directly on-column. The apparent overall increase in system sensitivity allowed detection and identification of compounds at lower levels than were previously possible. A table of compound recoveries lists the recoveries from the Tenax-GC sorbent for the standards used in this experiment.
GRA

N81-13116# Sandia Labs., Livermore, Calif. Applied Mathematics Div.
EFFECTS OF SELECTIVE DIFFUSION ON THE STABILITY OF BURNER-STABILIZED PREMIXED FLAMES
Stephen B. Margolis Dec. 1979 34 p refs Sponsored by DOE
(SAND-79-8805) Avail: NTIS HC A03/MF A01

The effects of selective diffusion, or multiple Lewis numbers, on the one dimensional stability of an isobaric burner-stabilized premixed flame is investigated for arbitrary stoichiometry and reaction order in the asymptotic limit of large activation energy. Utilizing a global reaction model it is shown that, unlike most adiabatic flames, many burner-stabilized flames are unstable to arbitrarily small normal mode disturbances under easily achievable conditions. In particular, when certain parameters pass through critical values, the nontrivial steady-state solution undergoes a supercritical Hopf bifurcation to a pulsating, or time-oscillating, solution branch. In the present work, the previous restrictive assumption that Le sub f = Le sub o is relaxed to allow for unequal diffusion of fuel and oxidizer. This results in a number of interesting and significant effects on the location of the stability boundary in parameter space. The results are particularly relevant to complex hydrocarbon flames, where the heavier hydrocarbon fuel may have a significantly higher Lewis number than the oxidizing species. Author

N81-13117# Sandia Labs., Albuquerque, N. Mex. Surface Chemistry and Analysis Div.
THE CHEMICAL ANALYSIS OF THIN FILMS AT SANDIA NATIONAL LABORATORIES
D. R. Tallant and E. L. Taylor May 1980 45 p refs Sponsored by DOE
(SAND-80-0605) Avail: NTIS HC A03/MF A01

Techniques for the wet chemical analysis of thin films of Si:Al, P2O5:SiO2, B2O3:SiO2, TiBx and TaBx are described. The analyses were complicated by the small total quantities of these analytes present in the films, the refractory characters of these analytes, and the possibility of interferences from the substrates on which the films were deposited. Etching conditions are described which dissolve the thin films without introducing interferences from the substrates. A chemical 'amplification' technique and inductively coupled plasma atomic emission spectrometry were shown to provide the sensitivity required to measure the small total quantities (micrograms to milligrams) of analytes present. Also the chemical analysis data was used to calibrate normal infrared absorption spectroscopy to give fast estimates of the phosphorus and/or boron dopant levels in thin SiO2 films. Author

N81-13118# Sandia Labs., Livermore, Calif.
FUNDAMENTAL COMBUSTION AND DIAGNOSTICS RESEARCH AT SANDIA Progress Report, Jan. - Mar. 1980
D. L. Hartley and M. A. Gusinow, ed. Jun. 1980 39 p refs Sponsored by DOE
(SAND-80-8223) Avail: NTIS HC A03/MF A01

The overall research program addresses: detailed chemistry of combustion, fundamental processes associated with laminar and turbulent flames development of research techniques specifically applicable to combustion environments, and operation of the user oriented Combustion Research Facility. Reports on the research sponsored by the Office of Basic Energy Sciences are presented. Activities in Combustion Research, Molecular Physics and Spectroscopy, and Diagnostics Research are described. Author

N81-13119# Bendix Corp., Kansas City, Mo.
ELECTROCHEMICAL FORM GRINDING Final Report
R. W. Stiles Jun. 1980 18 p refs
(Contract DE-AC04-76DP-00613)
(BDX-613-2275) Avail: NTIS HC A01/MF A01

Cutting tests were performed on stainless steel test bars to evaluate electrochemical form grinding. Methods of dressing a form into a grinding wheel, nozzle design, optimum machine settings, and tolerance capabilities were investigated. Metal bond and copper resin bond wheels in both diamond and aluminum oxide are available. The copper resin aluminum oxide wheels are easily formed and are the most adaptable type for form grinding. The wheel diameter should be as large as the machine can accommodate to provide better grinding speed, accuracy, and electrolyte flow. The electrolyte must be evenly distributed with a form fitting nozzle onto the wheel. A minimum of two passes must be made in electrochemical form grinding because of current density variations occurring throughout the cut, particularly on the initial pan. S.F.

N81-13120# Beet Sugar Development Foundation, Fort Collins, Colo.
TECHNICAL AND ECONOMIC FEASIBILITY OF MEMBRANE TECHNOLOGY Quarterly Technical Progress Report, 17 Mar. - 17 Jun. 1980
Andrew M. Shandre (American Crystal Sugar Co., Moorhead, Minn.) Jul. 1980 27 p
(Contract DE-AC03-79CS-40213)
(BSDF-39-3Q-80; QTPR-3) Avail: NTIS HC A03/MF A01

The potential application of reverse osmosis, ultrafiltration, and electrodialysis to the system of solids concentration in beet sugar process streams is investigated. All available membranes potentially applicable to the process are tested for application and durability under typical pH, heat, pressure and recycle

conditions. Possible reduction of energy requirements for evaporation to 15 to 20 percent is expected. S.F.

N81-13121# Sandia Labs., Livermore, Calif. Exploratory Chemistry Division 1.

A SINGLE APPARATUS FOR THE PRECISE MEASUREMENT OF THE PHYSICAL PROPERTIES OF LIQUIDS AT ELEVATED TEMPERATURE AND PRESSURE

D. A. Nissen Oct. 1980 27 p refs Sponsored by DOE

(SAND-80-8034) Avail: NTIS HC A03/MF A01

An instrument designed for measuring the viscosity, surface tension, and density of liquid at elevated temperature (900 C) and pressure (10 atm) is described. The theoretical principles, details of construction and operation, and response of the instrument are discussed in detail. As an example of the accuracy of the data generated by this instrument, the thermophysical properties of the molten equimolar mixture of NaNO3 and KNO3 were measured at 250 to 450 C and are shown to be in excellent agreement with the recommended literature values. Author

N81-13122# Sandia Labs., Albuquerque, N. Mex.

SUBSTITUTIONAL NITROGEN IN LASER-ANNEALED ION-IMPLANTED SILICON

K. L. Brower 1980 12 p refs Presented at the 11th Intern. Conf. on Defects and Radiation Effects Semicond., Oiso, Japan, 8 Sep. 1980

(Contract DE-AC04-76DP-00789)

(SAND-80-1617C; CONF-800961-1) Avail: NTIS HC A02/MF A01

Deep level N donors introduced by ion implantation and laser annealing were observed for the first time with electron paramagnetic resonance (EPR). Unlike the shallow group V donors, N has a donor level near the middle of the bandgap and exhibits a Jahn-Teller trigonal distortion as measured by EPR. DOE

N81-13123# Maryland Univ., College Park. Dept. of Chemistry.

NON-DESTRUCTIVE DETERMINATION OF TRACE-ELEMENT CONCENTRATIONS Annual Progress Report

Glen E. Gordon, William H. Zoller, and William B. Walters Aug. 1980 42 p refs

(Contract DE-AS05-76ER-05173)

(DOE/ER-05173/12) Avail: NTIS HC A03/MF A01

The neutron-capture prompt gamma ray activation analysis (PGAA) for trace element concentrations was used in several types of samples such as: volcanic samples which included yellow deposits found near volcanoes, fresh ash samples, and suspended particles in plumes from Mt. St. Helens with aircraft; energy related samples which were coal, coal fly ash, oil shale, shale oil and oil; biological samples of freeze dried blood and liver; neutron capture cross sections of borehole samples; and boron in semiconductor silicon. Recommended gamma ray lines for quantitative determinations, systems improvements of the beam filter system, second sample position and data handling facilities are included. DOE

N81-13124# Georgia Univ., Athens. Dept. of Chemistry.

MULTI-TEMPERATURE GAS CHROMATOGRPAHY USING ISOTHERMAL COLUMNS IN SERIES

W. A. Spencer and L. B. Rogers 11 Aug. 1980 38 p refs

(Contract DE-AS09-76ER-00854)

(DOE/ER-00854/30) Avail: NTIS HC A03/MF A01

A computer controlled three-oven gas chromatograph having a multi-position stream-switching valve is described which is used first to divide a wide-boiling mixture of n-alkanes into three cuts and then to fractionate each cut using a packed column at a different temperature. After initial injection of the sample into the highest temperature column, the low boilers are switched to a low temperature oven. Then, the mid-boilers are switched to a column at an intermediate temperature. For routine repetitive analyses, the multi-oven approach offers an attractive alternative. DOE

N81-13125# Sandia Labs., Albuquerque, N. Mex. Environmental Research Div.

LAGRANGIAN MEASUREMENTS OF SULFUR DIOXIDE TO SULFATE CONVERSION RATES

B. D. Zak 1980 30 p refs Sponsored by DOE

(SAND-80-2175C; CONF-801114-4) Avail: NTIS HC A03/MF A01

On the basis of Project MISTT data and proposed homogeneous gas phase oxidation mechanisms for sulfur dioxide, it was suggested that the degree of mixing with background air, the chemical composition of the background air, and the intensity of the sunlight available are key factors determining the rate of sulfur dioxide to sulfate conversion. These hypotheses were examined in light of Lagrangian measurements of conversion rates in power plant plumes made during the Tennessee Plume Study and Project Da Vinci. The Lagrangian conversion rate measurements are consistent with these hypotheses. It was also suggested that the concentration of ozone may serve as a workable surrogate for the concentrations of the free radicals involved in the homogeneous gas phase mechanism. Certain of the Lagrangian data indicate that this suggestion should be regarded with caution. Author

N81-13126# Sandia Labs., Albuquerque, N. Mex.

EXPERIMENTAL MEASUREMENT AND THEORETICAL CALCULATION OF LOW VAPOR PRESSURES AT LOW TEMPERATURES

Curt Ferdinand Mundel Jul. 1980 47 p refs Transl. into ENGLISH from Z. Phys. Chem. (West Germany), v. 85, 1913 p 435-465

(Contract DE-AC04-76DP-00789)

(SAND-80-1614) Avail: NTIS HC A03/MF A01

Low vapor pressures for several inorganic substances were measured and then tested to see how these values fitted the equation established by Nernst. Current methods of measuring low vapor pressures are also discussed in detail. L.F.M.

N81-13127# Sandia Labs., Albuquerque, N. Mex.

THE DEFLAGRATION-TO-DETONATION TRANSITION PROJECT Progress Report, Dec. 1979 - Feb. 1980

Morton L. Lieberman, ed. Sep. 1980 76 p refs

(Contract DE-AC04-76DP-00789)

(SAND-80-1862/1) Avail: NTIS HC A05/MF A01

The development of small, safe, low-voltage, hot-wire detonators is described. Its major goals are the formulation of a modeling capability for deflagration-to-detonation transition (DDT) of the explosive 2-(5-cyanotetrazolato)pentaamminecobalt(III) perchlorate (CP); the development of improved DDT materials; the establishment of a data base for corrosion, compatibility, and reliability of CP-loaded detonators; and the design and development of advanced DDT components. Author

N81-13128# Sandia Labs., Albuquerque, N. Mex.

THREE BODY ION-ION RECOMBINATION COEFFICIENTS FOR RARE-GAS-HALOGEN MIXTURES

James M. Hoffman and James S. Moreno Aug. 1980 63 p refs Sponsored by DOE

(SAND-80-1486) Avail: NTIS HC A04/MF A01

Three body ion-ion recombination coefficients at 300 K are calculated for the process R(+) + S(-) + T yields RS + T (R = Ne, Ar, Kr, Xe, Ar2, Kr2, Xe2; S = F Cl, Br, I; T = He, Ne, Ar, Kr, Xe), for buffer gas (T) pressures from 0 to 30 atmospheres. Recombination coefficients are also calculated for NeKr(+), ArKr(+), NeXe(+), ArXe(+) and KrXe(+) with each of the negative halogen ions in a buffer gas which is one or the other of the positive ion constituents. Author

N81-13129*# National Bureau of Standards, Washington, D.C.

NBS: MATERIALS MEASUREMENTS Annual Report, Apr. 1979 - Mar. 1980

Jul. 1980 118 p refs

(NASA Order H-27954-B)

(NASA-CR-163815; PB80-223159; NBSIR-80-2082) Avail: NTIS HC A06/MF A01 CSCL 07D

Measurements in an Auger spectrometer of surface impurity concentrations on liquid gallium showed that the principle impurities were oxygen and carbon. The impurities showed a tendency to collect into plates or clumps. In Pb rich Pb-Sn off eutectic alloys, macrosegration caused by solutal convection was not reduced by vertical or horizontal fields of 0.1 T, but downward solidification virtually eliminated macrosegration in small diameter samples. Phase assemblages of selected compositions on the joints K(Fe0.5 Si-0.5) O2 -SiO2 and KFeO2 - SiO2 were

determined over a large range of oxygen partial pressures and the temperature range 800 C to 1400 C. GRA

N81-13130# North Carolina State Univ. at Raleigh. Dept. of Chemical Engineering.
SOLUBILITIES OF ACID GASES AND NITROGEN IN METHANOL Final Report, Sep. 1979 - Apr. 1980
J. K. Ferrell, R. W. Rousseau, and J. N. Matange May 1980 88 p refs
(Grant EPA-R-804811)
(PB80-212236: EPA-600/7-80-116) Avail: NTIS HC A05/MF A01 CSCL 07D

A thermodynamic model, developed to predict the equilibrium behavior of carbon dioxide, hydrogen sulfide, nitrogen, and methanol mixtures is described. The model uses the four suffix Margules equation to describe liquid phase nonidealites and the Soave modification of the Redlich-Kwong equation of state to describe the gas phase. Model parameters were obtained from previously published binary vapor/liquid equilibrium data. Vapor/liquid equilibrium data were obtained experimentally for CO2/H2S/N2/methanol mixtures at temperature and liquid compositions compared favorably with experimentally measured values. GRA

N81-13131 Purdue Univ., Lafayette, Ind.
DEVELOPMENT OF CLINICAL METHODOLOGY USING LIQUID CHROMATOGRAPHY WITH AMPEROMETRIC DETECTION Ph.D. Thesis
Gregory Cole Davis 1980 214 p
Avail: Univ. Microfilms Order No. 8027271

The goal of any bioanalytical method is to selectively extract information from a complex sample matrix which contains a great deal of chemical 'noise'. Liquid chromatography with electrochemical detection (LCEC) is an analytical technique that provides both the selectivity and the sensitivity needed for many of these measurements. A number of potentially useful clinical assays were developed based on this new technique for determination of small amounts of certain key metabolites. Dopamine beta hydroxplase (D beta H) activity was measured in human serum. Dopamine was used as the substrate and the enzymatic product, nonepinephrine, was isolated by selective adsorption onto aluminum oxide at high pH. The norepinephrine was eluted from the alumina by dilute acid and measured by LCEC. A unique column switching scheme was employed to flush the excess substrate to waste and thereby increased the sample throughout. The overall precision of the method was 5.5% relative standard deviation. Dissert. Abstr.

N81-13132 Iowa State Univ. of Science and Technology, Ames.
ION CHROMATOGRAPHY WITH LOW CAPACITY RESINS AND LOW-CONDUCTIVITY ELUENTS Ph.D. Thesis
Douglas Thomas Gjerde 1980 167 p
Avail: Univ. Microfilms Order No. 8028615

A system of anion chromatography is described for the separation and determination of inorganic and organic anions. The anions are separated on a column containing a macroporous anion exchange resin of a low capacity (0.007-0.07 mequiv./g). Only a dilute solution of an aromatic organic acid salt is needed as the eluent. The eluent conductance is sufficiently low so that a suppressor column is not needed and the separated anions can be detected with a simple conductance detector. Numerous examples of actual separations are shown. In some cases, concentrations of anions below 1 ppm could be detected. Equations are developed to help separate difficult mixtures of anions. A system of cation chromatography is described in which metal and ammonium ions are separated on a cation exchange column of low capacity and are detected with a conductivity detector. No suppressor column is needed. A nitric acid eluent is used to separate mixtures of alkali metal and ammonium ions, and an eluent containing an ethylenediammonium salt is used for the separation of alkaline Earth metal ions. Dissert. Abstr.

N81-13133 Purdue Univ., Lafayette, Ind.
ELECTROCHEMICAL STUDIES OF SOLUTION KINETICS. THE THEORY AND PRACTICE OF CHRONOAMPEROMETRY, WITH APPLICATION TO THE MECHANISM OF ACETAMINOPHEN TOXICITY Ph.D. Thesis
Carl Reeves Preddy 1980 411 p
Avail: Univ. Microfilms Order No. 8027326

A system for the collection an analysis of kinetic data from a computer-controlled, thermostatted pulse electrochemical instrument is fully described, including all aspects of the electronics, hardware, and software. The theory of potentiodynamic, hydrostatic electrochemical experimentation, especially double and single step chronoamperometry is presented. The influence of homogeneous kinetics is examined, with subsequent development of models based on simultaneous partial differential equations. Methods of effecting solution are considered. A method of approximate numerical solution called orthogonal collocation (OC) is developed from first principles. The advantages, limitations, and applications of OC are discussed, and several novel kinetic schemes and experiment geometries are solved. Dissert. Abstr.

N81-13134 California Inst. of Tech., Pasadena.
INFRARED PHOTOCHEMISTRY Ph.D. Thesis
David Scott Bomse 1981 181 p
Avail: Univ. Microfilms Order No. 8028423

Various aspects of infrared photochemistry are considered. Particular emphasis is given to multiphoton excitation and dissociation of gas phase polyatomic ions. Applications of these processes are described and specific examples are given. R.C.T.

N81-13135 California Inst. of Tech., Pasadena.
A STUDY OF FUNDAMENTAL REACTION PATHWAYS FOR TRANSITION METAL ALKYL COMPLEXES. 1: THE REACTION OF A NICKEL METHYL COMPLEX WITH ALKYNES. 2: THE MECHANISM OF ALDEHYDE FORMATION IN THE REACTION OF A MOLYBDENUM HYDRIDE WITH MOLYBDENUM ALKYLS Ph.D. Thesis
John Mitchell Huggins 1981 204 p
Avail: Univ. Microfilms Order No. 8028424

The rapid reaction under mild conditions of internal or terminal alkynes with methyl (acetylacetonato) (triphenylphosphine) nickel (1) in either aromatic or ether solvents was examined. In all cases vinylnickel products (2) were formed by insertion of the alkyne into nickel-methyl bond. These complexes were converted into a variety of organic products (e.g., alkenes, esters, vinyl halides) by treatment with appropriate reagents. Unsymmetrical alkynes gave selectively the one regioisomer with the sterically largest substituent next to the nickel atom. In order to investigate the stereochemistry of the initial insertion, an X-ray diffraction study of the reaction of 1 with diphenylacetylene was carried out. This showed that the vinylnickel complex formed by overall transinsertion was the product of the reaction. The reaction of CpMo(CO)2H with CpMo(CO)3R(2R double bond CH3, C2H5) gave rsie to the aldehyde RCHO and the dimers (CpMo(CO)3)2(3a) and (CpMo(CO)2)2 (4a). Labeling one of the ractants with a methylcyclopentadienyl ligand it was possible to show that the mixed dimers MeCpMo(CO)3 - (CO)3MoCp(3b) and MeCpMo (CO)2 triple bond (CO)2MoCp(4b) are the predominant kinetic products of the reaction. Dissert. Abstr.

N81-13136 Iowa Univ., Iowa City.
SYNTHESIS, ELECTROCHEMISTRY, AND NMR STUDIES OF IRON PORPHYRINS Ph.D. Thesis
Martin Allen Phillippi 1980 237 p
Avail: Univ. Microfilms Order No. 8028288

The systematic syntheses of one-electron oxidized ferric porphyrin monomers were carried out and products were characterized by visible ultraviolet spectroscopy, cyclic voltammetry, electron paramagnetic resonance, variable temperature NMR, Mossbauer, and infrared spectroscopy. Proton and carbon-13 NMR were used extensively to characterize the oxidized ferric porphyrins in solution. In particular, proton NMR spectroscopy provides a powerful means for monitoring redox titrations and reactions with ligands such as imidazole. The one electron oxidation product of ferric octaethylporphyrin, etioporphyrin, mesoporphyrin dimethyl ester, and tetraphenylporphyrin chloride derivatives were characterized as iron (III) complexes coupled to a porphyrin pi cation radical. Dissert. Abstr.

N81-13137 Maryland Univ., College Park.
APPLICATION OF FOURIER TRANSFORM NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY TO ELEMENTAL ANALYSIS IN THE MILLIGRAM RANGE Ph.D. Thesis

Margaret Elizabeth Tierney 1980 148 p
Avail: Univ. Microfilms Order No. 8027147

The use of Fourier transform nuclear magnetic resonance (NMR) spectroscopy for quantitative elemental analysis in the milligrams range is investigated. Classical digestion of the phosphorus containing organics was used initially to provide the simplified condition of a single sample peak at a constant frequency in relation to the reference peak. Fourier transform NMR was successful for phosphorus analysis of digested samples so the more difficult condition of intact samples with multiple peaks over a range of frequencies was examined. The potential for general applicability of Fourier transform NMR to elemental analysis was further explored by investigating boron determination. Dissert. Abstr.

N81-13138 Illinois Univ. at Urbana-Champaign.
INVESTIGATION OF THE CHEMILUMINESCENT REACTION BETWEEN LUCIGENIN AND ORGANIC REDUCTANTS AND ITS APPLICATION AS A DETECTOR FOR HIGH PRESSURE LIQUID CHROMATOGRAPHY Ph.D. Thesis
Robert Lawrence Veazey 1980 212 p
Avail: Univ. Microfilms Order No. 8026608

The reaction of basic lucigenin (N,N-dimethyl-9,9-biacridinium dinitrate) with organic reductants was investigated as an analytical tool. The stopped flow data indicated that simple one-component samples of ascorbic acid, creatinine, uric acid, glutathione, glucuronic acid, lactose, and glucose can be quantitatively measured within their important clinical concentration ranges. Two component mixtures of glucose and ascorbic acid were observed to exhibit a response which was a simple addition of their individual responses. Continuous flow instrumentation was designed, built, and tested. Reagent delivery and flow cell design were shown to play an important role in achieving reproducible and reliable data. Ascorbic acid and dehydroascorbic acid were quantitated in the effluent of a high pressure liquid chromatograph, utilizing the chemiluminescence detector. Vitamin C tablets were assayed using the technique, yielding data that agreed to within 1-5% of titration results. A separation of glucose, glucuronic acid, uric acid, and ascorbic acid on an anion exchange column, at concentrations within their clinical ranges, was detected via the chemiluminescence method. Dissert. Abstr.

N81-13139 Purdue Univ., Lafayette, Ind.
MODULATED GAIN SPECTROSCOPY Ph.D. Thesis
William Thomas Barnes, Jr. 1980 213 p
Avail: Univ. Microfilms Order No. 8027253

A synchronously pumped dye laser is used as the basis for construction of a cw pump/probe spectrometer. In addition to the source limited time resolution offered by pump/probe methods in general, this instrument is shown to be capable of spectral measurements by virtue of its tunability. The previously neglected application of this technique to quantitative analysis is considered. A proposal for a unique design in these experiments is presented. The instrument design considerations are outlined. The operating principles are discussed, as well as the difficulties encountered. Chief among these are reflective feedback, noise, and the thermal lens effect. Dissert. Abstr.

N81-13140 Florida Univ., Gainesville.
THEORETICAL CONSIDERATIONS, AND EXPERIMENTAL COMPARISONS, OF SEVERAL FIGURES OF MERIT FOR A VARIETY OF ATOMIC PLASMA SPECTROSCOPIC TECHNIQUES Ph.D. Thesis
Sam Bayer 1980 111 p
Avail: Univ. Microfilms Order No. 8029043

The techniques of pattern recognition are proposed as being able to bring together any analytical problem with an existing suitable analytical technique. An example of the analytical capabilities of pattern recognition is given via the discrimination of the geographical origins of frozen concentrated orange juice by looking at the trace metal content of five selected fingerprinting elements (barium, boron, manganese, gallium and rubidium). The focal point of the problem is determined to be the recognition and development of suitable descriptors to be used in the pattern recognition problem. To this end, outlines for developing numerical estimates of such descriptors as linear dynamic range, cost of analysis, time of analysis and selectivity are given. Experimental verification of the theoretical definition of selectivity is given by the analysis of several elements in a simulated sea water matrix via atomic absorption and atomic emission spectrometric techniques. The final descriptor proposed is a theoretically calculated limit of detection. Dissert. Abstr.

N81-13141 Illinois Univ. at Urbana-Champaign.
NOVEL DISCOVERIES ABOUT THE SPIN-CROSSOVER TRANSITION IN SCHIFF-BASE FERRIC COMPLEXES Ph.D. Thesis
Muin Shawki Haddad 1980 230 p
Avail: Univ. Microfilms Order No. 8026506

The high spin to low spin conversion was studied in pseudo-octahedral ferric complexes [Fe-111(X-SalEen)2]Y. The ligand, X-SalEen, is obtained by the Schiff-base condensation of salicylaldehyde, 3-OCH3-salicylaldehyde, or 5-OCH3-salicylaldehyde with ethyl ethylene diamine. The anion, Y, used is NO3(-), PF6(-) or BPh4(-). Magnetic susceptibility measurements revealed that, like other spin crossover ferrous or ferric complexes, the effective magnetic moment per iron (mu sub eff/Fe) vs. temperature curves are puzzling. Mossbauer and EPR spectroscopies indicate that, regardless of the type of mu sub eff/Fe vs. temperature curve, only molecules in the high spin and low spin states exist. The effect of grinding or doping crystalline solids is discussed in terms of defects introduced into the unperturbed solids. Dissert. Abstr.

N81-13142 Purdue Univ., Lafayette, Ind.
NMR STUDIES OF Pt(II) COMPLEXES OF NUCLEOSIDES AND NUCLEOTIDES Ph.D. Thesis
Robert Ellas Duncan 1980 324 p
Avail: Univ. Microfilms Order No. 8027276

Proton and C13 nuclear magnetic resonance (NMR) spectroscopy were used extensively in studying the interactions of various concentrations of enPt2 and cis-(H3N)2Pt2 with 25 nM purine and pyrimidine nucleoside and nucleotide solutions. These studies were made over wide pH and concentration ranges. The reactivity of the Pt2 complexes is kinetically, not thermodynamically controlled. Both cytidine and uridine react with Pt in aqueous solution. Cytidine reacts fairly rapidly; its reactions being complete after a few hours, while uridine requires many days for its reactions to reach completion. Both nucleosides are bound at N-3 by the metal ion. In each system both the mono and bis nucleoside complexes are formed. The NMR evidence is given for a secondary binding site on cytidine but not for uridine. The effect of pH upon the H resonance of the en ligand is also discussed. The effects of platination on the chemical shift of the cytidine protons is small when compared to protonation at N-3. No reaction occurred at the C-5 position of either pyrimidine ring. A greater ring current diamagnetic anisotropy was observed in the Pt/Urd system than in the corresponding Pt2/Cyd system.
Dissert. Abstr.

N81-13143 Notre Dame Univ., Ind.
STOCHASTIC THEORY OF CHEMICAL KINETICS IN FINITE VOLUMES Ph.D. Thesis
Michael David Hatlee 1980 111 p
Avail: Univ. Microfilms Order No. 8028459

A stochastic theory is developed to describe a certain class of problems in chemical reaction kinetics. Specifically, for each reaction studied, the molecules involved in the reaction are distributed independently among the isolated systems of finite volume which constitute the ensemble. Five irrevesible elementary reactions of kinetic orders 1, 2, and 3 are studied. Comparisons and contrasts are drawn between the kinetic properties of the reaction in an unconfined medium and the apparent kinetic properties in the ensemble characterized by compartmentalization of reaction volumes. Of particular interest are the changes in the qualitative and quantitative nature of the observed rate constant and the existence of a nonzero steady state at infinite time. A second order reversible reaction is studied to explore the effects of confinement on the character of the equilibrium state. The changes in apparent rate constant seen for irreversible reactions are also found for reversible reactions. Dissert. Abstr.

N81-13144 Purdue Univ., Lafayette, Ind.
SOLAR CONVERSION AND ENERGY STORAGE BY THE CHLOROPHYLL A DIHYDRATE PHOTOCATALYTIC DECOMPOSITION OF WATER AND REDUCTION OF CARBON

DIOXIDE Ph.D. Thesis
Daniel Ray Fruge 1980 203 p
Avail: Univ. Microfilms Order No. 8027280

The photoconversion and storage of visible light energy based on the cell reactions of water photolysis by crystalline chlorophyll a dihydrate is described. The role of water on the photochemical activity of chlorophyll a is examined by a study of a photogalvanic cell consisting of a Pt/Chl a photocathode and a Chl a-free anode. The production of H(+) and OH(-) ions in the water oxidation and reduction half reactions is established by acid base titration. The observed photogalvanic current is decomposed into two contributions attributable to the markedly different rates of hydrogen evolution from elementary photochemical reactions initiating at the Chl a-H2O and Pt-Chl a interfaces. The dependence of the photocurrent on sample equilibration with water is examined relative to the enhancement of the diffusion coefficient for electron hole pair migration in (chla.2H2O)(n) on impregnation of the chlorophyll film by excess water. It is shown that (Chl a.2H2O) (n) catalyzes water photolysis on illumination by red light and that this capability is greatly enhanced by platinization of the chlorophyll. Dissert. Abstr.

N81-13145 Georgia Univ., Athens.
METAL SPECIATION BY LIQUID CHROMATOGRAPHY/ ATOMIC SPECTROMETRY Ph.D. Thesis
John Andrew Koropchak 1980 130 p
Avail: Univ. Microfilms Order No. 8029135

Investigations for the improvement of online atomic spectrometric detection of liquid chromatographic effluents are discussed. Nonaspirating orientations of commercial concentric pneumatic nebulizers, which are unsuited for use in ordinary flame atomic absorption spectrophotometry, are found to be ideal for on line liquid chromatographic use. Operating nebulizers under slight backpressures reduces the possibility of gas bubble formation within the chromatographic system and eliminates the need for post column sample dilution. It is further shown that improved signal to noise ratios can be achieved under these conditions due to improved droplet characteristics and transport efficiencies. The development of chromatographic techniques for the separation of metal species is also discussed. Dissert. Abstr.

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N81-13146 Stanford Univ., Calif.
ALLOY FACTOR ON THE CHEMISORPTION AND SURFACE REACTIVITY OF TRANSITION METAL SURFACES Ph.D. Thesis
Edward Mark Silverman 1980 624 p
Avail: Univ. Microfilms Order No. 8024742

The chemisorption of hydrogen and carbon monoxide and the decomposition of formaldehyde and formic acid were examined on a (110)-oriented copper/nickel alloy single crystal which had a bulk composition of 10% copper-90% nickel and a (100)-oriented nickel/iron alloy single crystal which had a bulk composition of 76% nickel-24% iron. The Cu/Ni alloy surface was varied in composition from 100% Ni to 35% Ni by sputtering and annealing at different temperatures. The surface composition of the Ni/Fe alloy sample was found to be only slightly enriched after annealing, but Fe segregation was enhanced by oxygen adsorption of the Ni/Fe surface at room temperature. The chemisorption of carbon monoxide and hydrogen on the Cu/Ni surfaces was studied by flash desorption spectroscopy and Auger electron spectroscopy. Different adsorption sites of carbon monoxide, identified in the desorption spectra of CO from the alloy surfaces at saturation coverage, were associated with desorption from ensembles consisting of Ni atoms, Cu atoms, and Cu-Ni pairs.
Dissert. Abstr.

N81-13147 Notre Dame Univ., Ind.
A STUDY OF SUB-CRITICAL CRACK GROWTH IN A Ni-BASE SUPERALLOY Ph.D. Thesis
Narasimhan Sridhar 1980 146 p
Avail: Univ. Microfilms Order No. 8028473

A simple fracture mechanics test method, called the double torsion test, was used to study crack growth phenomenal in Hastelloy Alloy C-276. Hydrogen was introduced into the material by electrolytic charging. A typical three stage behavior of crack velocity vs. stress intensity was observed. The crack velocity was increased by increasing hydrogen charging current density. Crack growth process was found to be stepwise, the features of which depended on the aging treatment and applied stress intensity factor. A crack growth model is proposed which involves nucleation of a microcrack at a critical site ahead of the main crack and its coalescence. A critical concentration of hydrogen is required for the nucleation of the microcrack. The most consistent mechanism responsible for transporting Hydrogen to the critical site was found to be dislocation transport. The effect of aging in increasing the crack velocity was rationalized to be due to the aging induced ordering process affecting the deformation mode. At short aging times, however, an alternative mechanism involving grain boundary segregation of P could also explain the increased crack velocity. Dissert. Abstr.

N81-13148 Notre Dame Univ., Ind.
EFFECTS OF LOW-TEMPERATURE AGING ON SOME NI-BASED SUPER-ALLOYS Ph.D. Thesis
Paul David Johnson 1980 156 p
Avail: Univ. Microfilms Order No. 8028461

The austenitic nickel base superalloy, Hastelloy alloy C-276, was found to undergo a slow ordering reaction at temperatures near and below 500 C. A complex sequence of ordering steps occurred with the formation of short range ordered atom clusters after about one hour at 500 C followed by an imperfectly ordered DO sub 22 structure. Ultimately ordered domains with an orthorhombic D sub 2h(25) superlattice appear. In aging at 500 C domains approximately 10 A across appeared after 100 hours, growing to 50 to 100 angstroms after 1000 hours and 100 to 250 angstroms after 6000 hours. The formation of the order did not appear to be significantly affected by cold work prior to aging. The appearance of well ordered domains in the alloy coincided with a change in the deformation mode of the alloy in simple tensile testing up to 500 C. The presence of the ordered domains caused deformation to occur by deformation twinning rather than by fcc type dislocation glide. This alteration in deformation behavior resulted from a decrease in the tendency for the glide of unit fcc dislocations in the ordered lattice with little change in the tendency for deformation twinning to occur.
Dissert. Abstr.

N81-13149 Illinois Univ. at Urbana-Champaign.
CORROSION OF ALUMINUM-IRON EUTECTIC COMPOSITES Ph.D. Thesis
Neal Steven Berke 1980 119 p
Avail: Univ. Microfilms Order No. 8026454

The corrosion of Al-Al3Fe eutectic composites and individual phases, prepared by employing directional solidification or special mechanical processing to vary microstructure, was studied under conditions of preferential corrosion of the Al3Fe second phase in 2.4 M H2SO4 and preferential corrosion of the aluminum matrix by pitting in 5.0 M NaCl at pH.1.0. The iron like Al3Fe phase provided the total cathode reaction in both solutions and the corrosion rate depended on the metallographic parameter Sv, the surface area of Al3Fe in the volume. The Sv is proportional to 1/L bar, where L/bar is the mean intercept spacing.
Dissert. Abstr.

N81-13150 California Univ., Davis.
HYDROGEN ASSISTED CRACKING OF A LOW ALLOY STEEL: PRESSURE, TEMPERATURE AND YIELD STRENGTH EFFECTS ON THE THRESHOLD FRACTURE TOUGHNESS Ph.D. Thesis
Grosvenor Cook Story, III 1980 214 p
Avail: Univ. Microfilms Order No. 8027090

The Model I threshold stress intensity for cracking of an AISI 4340 steel was determined as a function of gaseous hydrogen pressure, test temperature and material yield strength. Wedge opening loaded (WOL) fracture toughness specimens loaded by a bolt and load cell were used in the hydrogen assisted cracking experiments. The data collected substantiates the existence of a critical crack tip stress state/hydrogen concentration relationship. The positive heats of solution calculated from the

experimental data show that hydrogen interaction with material defects (e.g., dislocations, grain boundaries and interfaces) plays the dominant role in hydrogen assisted cracking. Relative estimates of the hydrogen concentration at critical defect sites were calculated and found to be consistent for the material conditions evaluated. The effect of hydrogen on dislocation mobility and on the ability of grain boundaries to accommodate plasticity is discussed in terms of a qualitative model for hydrogen assisted cracking. Areas for future research are enumerated.
Dissert. Abstr.

N81-13151 *Northwestern Univ., Evanston, Ill.*
HIGH VOLTAGE ELECTRON MICROSCOPY AND SMALL ANGLE NEUTRON SCATTERING INVESTIGATION OF *GRAIN BOUNDARY CAVITATION IN HIGH PURITY* COPPER Ph.D. Thesis
Richard Allen Page 1980 171 p
Avail: Univ. Microfilms Order No. 8026890

The nucleation and growth of grain boundary cavities in high purity copper was investigated using the complimentary techniques of high voltage electron microscopy and small angle neutron scattering to examine small voids which were totally enclosed in the foil and the dislocation structure and the grain boundary structure surrounding the voids. The number and the total volume of the cavities in a bulk specimen were measured. Under cyclic loading conditions cavities were found to nucleate at serrations on the boundary where an area of high dislocation density intersected the grain boundary. Extrapolation of curves of total cavity volume vs. fatigue time failed to reveal any incubation time for cavity nucleation, thus eliminating classical nucleation as a viable mechanism. No evidence was found to suggest that the small individual cavities were growing by plastic deformation. The cavity shape suggests that the grain boundary diffusivity was limiting growth. The growth rates of individual cavities were determined from the nucleation rate and the rate of change of the total void volume. Dissert. Abstr.

N81-13152 Northwestern Univ., Evanston, Ill.
CYCLIC DEFORMATION OF A SPINODAL CuNiSn ALLOY *Ph.D. Thesis*
Mary Patricia Quin 1980 118 p
Avail: Univ. Microfilms Order No. 8026903

The effect of strengthening by spinodal decomposition on fatigue behavior is investigated in Cu-10 w/o Ni-6 w/o Sn. The homogeneous alloy, quenched from the single phase, has a yield strength of 185 MN n(-2) but when CuNiSn is aged below the spinodal temperature at 350 C the coherency strains, produced by the growth of periodic composition fluctuations, result in yield strength as high as 780 MN n(-2). During low cycle strain controlled fatigue tests the as quenched alloy hardened throughout the fatigue life. For all aging times the alloy hardened only for the first few percent of fatigue life then softened until failure. Amplitude of the composition modulations was found to decrease with the number of fatigue cycles while wavelength remained constant. The cyclic softening is therefore attributed to a fatigue induced demodulation of the spinodal microstructure. Transmission electron microscopy studies of the fatigue specimens revealed uniform dislocation cells in homogeneous CuNiSn but localized deformation in the aged specimens. Large areas of the aged CuNiSn fatigue specimens showed typical contrast due to spinodal decomposition and contained either no deformation of low density planar arrays of dislocations. High cycle fatigue specimens are also discussed. Dissert. Abstr.

N81-13153# Cincinnati Univ., Ohio. Dept. of Materials Science and Metallurgical Engineering.
DEVELOPMENT OF A MECHANICALLY ALLOYED ALUMINUM ALLOY FOR 450-650 DEG F SERVICE Final Report, 1 Jul. 1978 - 30 Sep. 1979
Donald L. Erich Wright-Patterson AFB, Ohio AFML Jan. 1980 90 p refs
(Contract F33615-76-C-5227; AF Proj. 7351)
(AD-A090597; AFML-TR-79-4210) Avail: NTIS HC A05/MF A01 CSCL 11/6

This investigation was aimed at gaining an understanding of the factors controlling room and elevated temperature strength in aluminum and aluminum alloys prepared by mechanical alloying (M/A). Room temperature strength was found to be controlled by retained cold work, grain size, dispersoid content, precipitation hardening and the presence of low solubility addition elements. Decreasing effectiveness of these factors was found at elevated temperatures and, in fact, the solid solution/precipitation hardening elements decreased strength. Stress-rupture and creep properties were defined as a function of stress, time and alloy additions. The most beneficial addition elements were found to be Ti or a combination of Fe-Cr. Stress to produce 0.2% creep strain in 100 hours was estimated to be 22.6 ksi at 450 F and 13.9 ksi at 650 F. Attempts to improve creep resistance by increasing grain size through variations in hot working were unsuccessful. Creep strength at 450 F was less in the grain coarsened materials than in those with fine grains, and at 650 F was independent of grain size over the limited range evaluated. Continued attempts at affecting recrystallization to a coarse elongated grain morphology, as achieved in nickel base systems, should be made. Such a structure is expected to increase creep strength at service temperatures greater than 50% of the absolute melting point, 380 F in the case of Al. GRA

N81-13154# Pratt and Whitney Aircraft Group, West Palm Beach, Fla.
***WEAR RESISTANT COATINGS FOR TITANIUM* Final Report, 18 Sep. 1978 - 18 Sep. 1979**
P. L. McDaniel and R. E. Fishter Jul. 1980 76 p
(Contract N00019-78-C-0489)
(AD-A091053; PWA-FR-12303) Avail: NTIS HC A05/MF A01 CSCL 11/6

During this third program phase, an intensive investigation was conducted to further evaluate the effect of various pulse settings on the properties of the coatings produced. Variations in cathode efficiency, molybdenum content, surface morphology, and hardness were related to changes in these pulse settings. The effects of plating solution composition and temperature on these properties were also studied. The completion of this third phase has provided additional information on the properties of chromium-molybdenum coatings on both steel and titanium, singled out specific pulse settings and heat treatments as optimal for producing wear resistant coatings on various alloys, and established standards for the properties and uses of the plating. GRA

N81-13155# AiResearch Mfg. Co., Phoenix, Ariz.
HOT ISOSTATIC PRESSING/HEAT TREATMENT OF CAST *SUPERALLOY, AF2-1DA, RADIAL TURBINE WHEELS* Final Report, 6 May 1975 - 15 Jul. 1979
James R. Kidwell, David V. Sundberg, and Muneo Fujii Wright-Patterson AFB, Ohio AFWAL Jun. 1980 56 p
(Contract F33615-75-C-2016)
(AD-A091305; AiResearch-31-3292; AFWAL-TR-80-4076) Avail: NTIS HC A04/MF A01 CSCL 11/6

Forty AF2-1DA alloy radial turbine wheels were cast and X-ray inspected. Thirty-eight wheels were free of obvious defects and selected for evaluation. As-cast elevated temperature tensile strength was measured and as-cast/heat threated tensile and stress-rupture properties were determined. Eight wheels were HIPped in four combinations with temperatures varying from 2150 to 2250 F, pressures of 15 or 29 ksi, and a constant three hour time period. Four solution heat treatment temperatures were selected based on a previous investigation to cast a modified AF2-1DA alloy composition (AFML Contract Number F33615-71-C-1573). Evaluations were performed using four HIP conditions and eight HIP/heat treatment combinations of four wheels each. Samples were examined metallographically and tensile and stress-rupture properties were determined. Four HIP/heat treatment combinations were selected for LCF testing on the basis of acceptable microstructures and mechanical properties. Room temperature strain-control LCF tests were performed and results analyzed on a Weibull distribution. Data analysis indicated that LCF life improvement was obtained through HIP and heat treatment. Specifically, a 3X LCF life improvement was achieved for as-cast wheels predicted to fail in less than 1000 cycles. GRA

N81-13156# Pennsylvania State Univ., University Park. Dept. of Materials Science and Engineering.
A MODEL FOR DECREASING HYDROGEN ABSORPTION IN METALS APPLICABLE TO ION IMPLANTED MEM-

BRANES Technical Progress Report
H. W. Pickering and M. Zamanzadeh 20 Oct. 1980 16 p refs
(Contract N00014-75-C-0264)
(AD-A091294; TR-13) Avail: NTIS HC A02/MF A01 CSCL 07/4

A model is presented for decreasing hydrogen absorption by catalyzing the hydrogen evolution reaction (h.e.r.). Its salient features are the presence of a metal on the substrate surface with a higher exchange current density for the h.e.r. than that of the substrate, and a mechanism of hydrogen evolution for which the coverage of the surface is a function of the overpotential. Pt-implanted Fe membranes are evaluated with regard to their catalytic character for the h.e.r. using a Devanathan-Stachurski permeation cell. These data are in full accord with, and illustrate, the above model for decreasing H absorption. Factors affecting the choice of implants for decreasing hydrogen absorption (via modification of the overpotential and the hydrogen coverage) include the nature of the implanted species for catalyzing the h.e.r.; the concentration profile of the implanted species, in particular its concentration in the surface atomic layer(s); and the tendency for enrichment of the surface in the implanted species, as occurs during open circuit corrosion. These factors are illustrated in the data. GRA

N81-13157# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
THRESHOLDS FOR FATIGUE INITIATION AND PROPAGATION AND PLASTIC WORK IN HY80 AND HY130 STEELS Annual Report, 1 Sep. 1979 - 31 Aug. 1980
Morris E. Fine 16 Oct. 1980 15 p refs
(Contract N00014-78-C-0565)
(AD-A091345) Avail: NTIS HC A02/MF A01 CSCL 11/6

The effect of tempering temperature on the fatigue crack propagation rate (FCPR) in the mid-stress intensity range of HY130 austenitized at 815 C was determined. Three treatments giving the same hardness, R.C. 34, were selected: A - 10 hrs at 400 C, B - 5 hrs at 550 C, and C - 1/4 hr at 650 C. There was little difference in the rates either when the testing was done in air (55% relative humidity) or dry argon. Previously, a ten times larger FCPR was observed in specimens tempered 1 hr at 610 C when the tests were carried out in air rather than dry argon. Changing the tempering furnace from a salt pot to a dry argon tube furnace and water quenching from 610 C rather than air cooling seemed to cure the problem. The threshold for macrofatigue crack propagation was measured in commercially pure iron in both center notch and side notch specimens. Both specimen geometries have the same results, delta k(th) - 6 MN/sq root of m cubed. GRA

N81-13158# Dayton Univ., Ohio.
SURFACE CHARACTERIZATION OF CHEMICALLY ETCHED Ti-8Al-1Mo-1Sn AND Ti-13V-11Cr-3Al Final Report, Jun. 1979 - Feb. 1980
J. S. Solomon, A. A. Roche, and W. L. Baun Aug. 1980 43 p refs
(Contract F33615-78-C-5102; AF Proj. 2419)
(AD-A091230; AFWAL-TR-80-4105) Avail: NTIS HC A03/MF A01 CSCL 11/6

The effects of chemical treatments on surfaces of Ti8Al-1Mo-1Sn and Ti-13V-11Cr-3Al were characterized with Auger electron spectroscopy, ion scattering spectroscopy, secondary ion mass spectroscopy,and scanning electron microscopy. The effects of particular treatments were not always the same for each alloy. In all cases the original surface oxide was replaced with a new one containing traces of elemental species common to a particular treatment. In most cases the oxide formed was identified as TiO2. The oxide formed on Ti-8Al-1Mo-1Sn by a fluorophosphate treatment was an oxyfluoride of titanium. GRA

N81-13159# Sandia Labs., Albuquerque, N. Mex.
CURRENT AND POTENTIAL DISTRIBUTIONS IN CORROSION SYSTEMS
William H. Smyrl 1980 22 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-0960C; CONF-800802-20) Avail: NTIS HC A02/MF A01

The mathematical methods used are described. The specific results for galvanic corrosion, cathodic protection, and localized corrosion are presented. Author

N81-13160# Sandia Labs., Albuquerque, N. Mex.
THE 14 MeV NEUTRON ACTIVATION ANALYSIS OF OXYGEN IN Li-Si ALLOYS FOR Li(Si)/FeS2 THERMALLY ACTIVATED BATTERIES
Richard W. Bild 1980 17 p refs
(SAND-80-1508C; CONF-801111-4) Avail: NTIS HC A02/MF A01

Development of a Li(Si)/FeS2 thermally activated battery required establishment of a 14 MeV neutron activation procedure for the determination of total oxygen (0.1 wt % and greater) in the Li-56 wt % Si alloy anode material used in the batteries. The method developed allows the reactive samples to remain in a controlled atmosphere throughout sampling and analysis. An interference due to triple random coincidence detection of A1-28 gamma rays produced by (n,p) reaction on Si-28 was observed. A simplified correction procedure, based on one by Nass but not requiring knowledge of the detector resolution time, was derived and evaluated. The correction procedure should be useful in the analysis of other low O, high Si materials such as Si metal, other Si-rich alloys, SiC and Si3N4. Geologic, meteoritic and lunar silicate materials commonly analyzed for O are low enough in Si content and high enough in O content that the interference is not significant. Some results of applying the analysis and correction procedure to thermally activated battery materials are described. Author

N81-13161# Sandia Labs., Albuquerque, N. Mex.
CORROSION PROBLEMS IN TiKClO4 LOADED DEVICES WHEN SUBJECTED TO HUMID ENVIRONMENTS
T. M. Massis, J. T. Healey, D. H. Huskisson, and W. G. Perkins 1980 17 p refs Presented at the ADPA Compatibility Meeting, Blacksburg, Va., 13 Oct. 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-0964C; CONF-801048-6) Avail: NTIS HC A02/MF A01

A piston motor/igniter loaded with a Ti/CKIO4 pyrotechnic and sealed with a silicone adhesive exhibited serious corrosion problems during aging. It was determined that these problems resulted from the combined presence of chlorine containing contaminants and atmospheric moisture. The aging tests indicate that external moisture was involved in the corrosion reaction. Calculation and experimentation showed the silicone adhesive used to seal these devices to be permeable to water vapor, and the moisture conditions inside the devices equilibrated with external conditions within a few hours. Corrosion and cracking was solved by eliminating the source of moisture by hermetically sealing the devices. DOE

N81-13162 Texas Univ. at Arlington.
CORROSION OF REINFORCING STEEL IN SULPHUR IMPREGNATED CONCRETE Ph.D. Thesis
Sikrit Hiranmas 1980 143 p
Avail: Univ. Microfilms Order No. 8028543

Water cement ratios type of sulphur used for impregnation, and the amount of impregnated sulphur were chosen as the variables. Sodium chloride solution with 5% concentration was used as the corrosive electrolyte. Two processes of study, the natural process and the accelerated process, were investigated. The natural process comprised continuous partial submersion of the specimen in salt solution. The natural process of corrosion in the embedded steel was then studied using the electrochemical approach. While in the accelerated process, the external current was impressed into each specimen to accelerate the natural process of corrosion. The quantities of impregnated sulphur required to completely prevent corrosion of the embedded steel for each concrete mix were established. The method to approximately predict the length of time the corrosion process takes to cause distress in concrete cover was also established. In addition, the effect of different thickness of concrete cover on corrosion of embedded steel was studied. Dissert. Abstr.

N81-13163 Illinois Univ. at Urbana-Champaign.
INTERNAL HYDROGEN EMBRITTLEMENT IN THE ALUMINUM-ZINC-MAGNESIUM SYSTEM Ph.D. Thesis
Stephen William Claraldi 1980 153 p

Avail: Univ. Microfilms Order No. 8026469

The internal hydrogen embrittlement of high strength aluminum alloys was investigated. The majority of experiments were performed using a high purity Al-5.5 wt pct Zn-2.5 wt pct Mg alloy hydrogenated to levels of up to 1 at pct either by mechanical polishing in aqueous solutions or by exposure to moist air. These specimens were observed to have reduced ductilities and fracture stresses during subsequent tensile tests in argon. Embrittlement was found to be reversible and could be suppressed by thermal treatments prior to testing. Strain rate was also found to influence the occurrence of embrittlement. Dissert. Abstr.

N81-13164 Syracuse Univ., N. Y.

THE REACTIVE SPUTTERING OF TANTULUM OXIDE Ph.D. Thesis

Timothy Martin Reith 1980 147 p

Avail: Univ. Microfilms Order No. 8026378

The reactive sputtering of Ta in O2 is investigated. It is shown that the variation observed in the partial pressure of O2 during both reactive and nonreactive Ta depositions is a sensitive measure of reactive surface activity in the plasma. A detailed examination of the O2 behavior was made as the degree of activity of either target or substrate is systematically changed. A correlation is made between observed O2 partial pressure variations and resulting compositional variations of the collected films using Auger electron spectroscopy. Auger sputter profiling, and transmission electron microscopy. From these complementary approaches, a number of conclusions are drawn regarding the nature of Ta-oxide reactive sputtering and specifically include: critical deposition parameters affecting the compositional uniformity of the sputtered films and methods for achieving stoichiometric material, preferential sputtering effects, positive phase identification of all observed phases, equations describing the Ta-O2 reaction at target and substrate as well as material transport through the plasma, and rate constants and time exponents for these reactions. Dissert. Abstr.

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N81-13165 Northwestern Univ., Evanston, Ill.

RHEOLOGICAL PROPERTIES OF POLYMERS IN THE LINEAR AND NONLINEAR VISCOELASTIC REGIMES Ph.D. Thesis

Edgar Vithal Menezes 1980 279 p

Avail: Univ. Microfilms Order No. 8026874

The viscoelastic properties of model polymer solutions were studied in the linear and nonlinear regimes. In the linear regime, a dilution study was done on narrow MWD linear and star branched polybutadienes in various solvents. Linear viscoelastic properties were obtained from dynamic data using the ERD experiment. The variations of these properties with concentration and molecular weight were compared with the predictions of current theories. Dissert. Abstr.

N81-13166*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF MILLING AND LEACHING ON THE STRUCTURE OF SINTERED SILICON

H. C. Yeh (Cleveland State Univ., Ohio), T. K. Glascow, and T. P. Herbell 1980 15 p refs Presented at Ann. Meeting of the Am. Ceram. Soc., Chicago, 28-30 Apr. 1980

(NASA-TM-81602; E-591) Avail: NTIS HC A02/MF A01 CSCL 07D

Sintering was performed in He for 16 hours at 1200, 1250, and 1300 C. Compacts of as-received Si did not densify during sintering. Milling reduced the average particle size to below 0.5 micrometer and enhanced densification (1.75 g/cc). Leaching milled Si further enhanced densification (1.90 g/cc max.) and decreased structural coarsening. After sintering, the structure of the milled and leached powder compacts appears favorable for the production of reaction bonded silicon nitride. Author

N81-13167# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.

REPETITIVE MOLECULAR EXCLUSION CHROMATOGRAPHY OF PGBx ON SEPHADEX LH-20

H. W. Shmukler, S. F. Kwong, W. Feely, M. G. Zawryt, E. Polis, and E. Soffer Oct. 1980 16 p refs Prepared in cooperation with Hahnemann Medical Coll. and Hospital, Philadelphia (WF58527003)

(AD-A091170; NADC-80183-60) Avail: NTIS HC A02/MF A01 CSCL 11/9

PGBx, a mixture of oligomers of 15 keto PGB1, was subjected to repetitive MEC on Sephadex LH-20 in an attempt to separate and purify the active principle. The resulting fractions were analyzed and found still to be heterogeneous. Although the MEC technique did not resolve the PGBx complex, low molecular weight fractions were obtained that may be amenable to mass spectral analysis. GRA

N81-13168# Johns Hopkins Univ., Baltimore, Md.

QUANTUM CHEMICAL INVESTIGATIONS OF THE MECHANISM OF CATIONIC POLYMERIZATION Summary Report, 1 Oct. 1979 - 30 Sep. 1980

Joyce J. Kaufman 15 Oct. 1980 27 p

(Contract N00014-80-C-0003; NR Proj. 093-064)

(AD-A091249; TR-1) Avail: NTIS HC A03/MF A01 CSCL 07/4

In the research on part 1 of this project we are carrying out ab-initio quantum chemical calculations and generating electrostatic molecular potential maps for cationic polymerization: on energetic monomers, on their interaction with catalysts and on the attack of the monomer-catalyst complexes on the substrates. This research is in support of an ongoing overall project of the Power Program Branch of ONR designed to develop energetic binders for use with energetic propellants. We are pursuing several approaches to the predictions of crystal structures and densities. The first is to calculate (from calculations on the super-molecules) the SCF intermolecular interaction, separate it into its various components and use these to construct the crystal structure. The second approach is to carry over the concept recently used successfully in calculations for biological systems where the same ab-initio calculations between two or several of such molecules for a large variety of inter-molecular configurations is used to derive atom class-atom pair-pair and three body potentials which are then used to calculate the intermolecular structure of an arrangement of molecules. GRA

N81-13169# General Electric Co., Philadelphia, Pa. Space Systems Organization.

MATERIALS AND PROCESS SCREENING APPLIED TO A REINFORCED PLASTIC PARABOLIC TROUGH CONCENTRATOR MODULE

Ronald Hodge, ed. and John M. Hogan Aug. 1980 77 p refs Sponsored by DOE

(SAND-80-7003) Avail: NTIS HC A05/MF A01

Existing parabolic trough solar collectors are basically sheet metal designs utilizing aluminum or steel as the major structural materials. The relatively high labor content associated with these sheet metal designs generated an interest in investigating the cost effectiveness of using reinforced plastics as a major structural material for trough solar collectors. This interest is bolstered by a growing desire on the part of industry to identify new material process combinations which save weight, use less energy, and require less capital equipment and assembly costs. The use of reinforced plastics as the basic material for a line focus parabolic trough concentrator module is reinforced. This module constitutes a basic building block with which longer trough rows can be built. The basic part analysis includes the quantification of key material and part function relationships. Candidate materials and processes are reviewed and, the costs associated with the most attractive combinations defined. Author

N81-13170# Ames Lab., Iowa. Dept. of Chemical Engineering.

POWER PLANT FLY ASH AS A RESOURCE FOR ALUMINA AND CEMENT

M. J. Murtha and George Burnet 1980 21 p refs Presented at the 89th Ann. Meeting of the AIChE, Portland, Oreg., 17 Aug. 1980

(Contract W-7405-eng-82)
(IS-M-289; CONF-800802-15) Avail: NTIS HC A02/MF A01

A sinter process developed to form soluble aluminate compounds from mixtures of fly ash, limestone, and soda ash is discussed. The aluminates are extracted, treated to remove silicates, and precipitated; the precipitate is calcined to metallurgical grade alumina. The extract residue shows promise as a raw material for the production of Portland cement. Process economics are presented, and the effects of alumina and silica contents of the fly ash, sintering temperatures and time, and sales credits for by-products are discussed. DOE

N81-13171# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center and Avionics Div.
SOLAR-SELECTIVE PAINT COATING DEVELOPMENT Final Report, 5 Jun. 1978 - 4 Dec. 1979
W. D. McKelvey, P. B. Zimmer, and R. J. H. Lin Dec. 1979 83 p refs
(Contract DE-AC04-78CS-34287)
(DOE/CS-34287/T1) Avail: NTIS HC A05/MF A01

Formulations and process conditions for thickness-sensitive paint coatings were defined. Pigments were evaluated, but none were found which can be used as a substitute for Ferro's F-6331. It was discovered that significant improvement in abrasion resistance was achieved by decreasing the pigment volume concentration without adversely affecting optical properties. Coating thermal stability, weathering and humidity resistance, and effects of pigment agglomeration size on coating optical performance were studied. It was evident that the selective paint coating is a viable alternative to selective black chrome and promises significant cost reduction. Additional developmental work is needed to bring the technology into the real world of production. Author

N81-13172# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
BASIC RESEARCH IN CRYSTALLINE AND NONCRYSTALLINE CERAMIC SYSTEMS Annual Report, 1 Aug. 1979 - 31 Oct. 1980
1980 101 p refs
(Contract DE-AS02-76ER-02390)
(DOE/ER-02390/5) Avail: NTIS HC A06/MF A01

The needs identified in the 1977 series of workshops on DOE programs in energy related materials research and by the ongoing efforts of the DOE Council on Materials Science were translated into the basic and applied research necessary to fulfill the established objectives in the effort to solve the nation's energy problems. Ceramics in numerous applications are critical in meeting national energy requirements. DOE

N81-13173# New York State Dept. of Transportation, Albany. Engineering Research and Development Bureau.
POLYMER COATINGS FOR CORRUGATED STEEL PIPE Interim Report
Robert M. Pyskadlo Oct. 1979 19 p refs Sponsored in part by Federal Highway Administration
(PB80-210487; FHWA/NY/SR-79/64; IR-1) Avail: NTIS HC A02/MF A01 CSCL 11C

Polymer coated culverts were installed in New York state. Two different products were used, 'Nexon', and 'Beth-Cu-Loy PC'. Shortly after installation, several Nexon coated pipes showed signs of abrasion. The causes of this early failure were studied. Included is a summary of site conditions at each of 71 culverts, together with results of a conditon survey. A survey of other state agencies using polymer coatings is also presented. GRA

N81-13174# Research Triangle Inst., Research Triangle Park, N. C.
A STUDY OF AN ELECTRODELESS GLOW DISCHARGE AS A MEANS OF MODIFYING THE SURFACE OF POLYMERS Final Report, 1 Nov. 1972 - 30 Nov. 1979
N. Morosoff and H. Yasuda 1980 160 p refs
(Contract N01-HV-3-2913)
(PB80-212715; RTI/0790/00-01F; NIH-N01-HV-3-2913-7) Avail: NTIS HC A08/MF A01 CSCL 11I

A method of modifying the surface of materials for use in prosthetic devices in contact with blood was developed by the deposition of glow discharge polymer. The effect of choice of monomer and of operational parameters on the chemical nature of the glow discharge polymer was extensively elucidated. Good reproducibility was demonstrated. The method therefore yields a very thin (50-100 A), highly adhesive and cohesive coating that does not affect the bulk properties of the substrate. Surfaces with a wide range of chemical properties are accessible by this technique. GRA

N81-13175# California State Dept. of Transportation, Sacramento. Office of Transportation Lab.
WATER-BASED COATINGS FOR PROTECTION OF STEEL STRUCTURES Final Report
Raymond Warness Nov. 1979 62 p refs Sponsored in part by DOT
(PB80-208994; TL-657282; FHWA/CA/TL-79/24) Avail: NTIS HC A04/MF A01 CSCL 11C

Various water based paints were evaluated by subjecting them to accelerated exposure tests according to ASTM methods. Results indicated that water based top coats generally performed satisfactorily when applied over an organic zinc rich primer. Similar tests made on water based primers and complete water based systems indicated that some of these coatings may be equal to or better than conventional solvent based alkyd type paints. Additional full scale field evaluations are currently being planned to further evaluate some of the water based coatings. GRA

N81-13176# Brown Univ., Providence, R. I.
INELASTIC BEHAVIOR OF PLASTICS Annual Report, 1979
J. H. Weiner Jan. 1980 16 p refs
(PB80-210693; GRI-78/0044) Avail: NTIS HC A02/MF A01 CSCL 11I

The major effort was directed towards the completion and utilization of a computer program capable of simulating the dynamics of realistic three dimensional macromolecular models. A computer program was developed which treats a long chain molecule as a system of linked rigid bodies, taking into account the effect of thermal motion. A theoretical expression was derived for the rate of barrier crossing in a three bond chain subjected to tension. Results indicate that this may provide approximations for longer chains. Computer simulation demonstrations show sharp differences in the statistical behavior of flexible and rigid macromolecular models. GRA

N81-13177 Illinois Univ. at Urbana-Champaign.
CROSSLINKING AND ENTANGLEMENT EFFECTS IN POLYBUTADIENE Ph.D. Thesis
Gregory Charles Munie 1980 171 p
Avail: Univ. Microfilms Order No. 8026563

Proton relaxation measurements were used to investigate the effects of crosslinking and entanglements on segmental motion in polybutadiene. The temperature dependence of T sub 1, the spin-lattice relaxation time, T sub 2, the spin-spin relaxation time, and T sub 1 sub rho, the spin-lattice relaxation time in the rotating frame, were studied for samples of well characterized crosslink density. These relaxation parameters were observed as a function of both temperature and pressure for uncrosslinked samples of narrow molecular weight distribution. The relaxation data were interpreted in terms of the effects of crosslinks and entanglements on segmental motion. Well characterized, lightly crosslinked networks of the narrow molecular weight distributed samples were prepared in both the bulk and dilute states. The temperature dependence of T sub 1, T sub 2, and T sub 1 sub rho for these networks was determined. The values of the Mooney-Rivilin constants, 2C sub 1 and 2C sub 2 for these networks were also measured. The nuclear magnetic resonance and bulk property measurements were interpreted in terms of the effects of the sol fraction and entanglements on chain motion. Dissert. Abstr.

N81-13178 Arizona Univ., Tucson.
INVESTIGATIONS OF POLYMER MEMBRANE ION-SELECTIVE ELECTRODES Ph.D. Thesis
Charles Raymond Martin 1980 154 p
Avail: Univ. Microfilms Order No. 8028523

Cation selective electrodes based on sulfonated polystyrene and on the perfluorinated, sulfonic acid containing ion exchange polymer NAFION 120 (trademark) were studied. To help answer

some of the questions encountered during these investigations of electrodes based on covalently attached sulfonate groups, polymer membrane electrodes based on dinonylnaphthalenesulfonic acid were prepared and investigated. These electrodes were found to have very great selectivity for high molecular weight organic cations relative to inorganic and smaller organic cations. This type of selectivity is analogous to that obtained in ion pair solvent extraction of cations with a high molecular weigh anionic species. Since a number of species of clinical, biological and toxicological interest are, at physiological pH, high molecular weight organic cations, electrodes based on dinonylnaphthalenesulfonic acid show great promise for determination of such species. An electrode for the determination of the drug phencyclidine was prepared to demonstrate the potentialities of drug analysis with this type of electrode. Dissert. Abstr.

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N81-13179# Committee on Science and Technology (U. S. House).
OVERSIGHT: ALCOHOL FUEL OPTIONS AND FEDERAL POLICIES, VOLUME 3
Washington GPO 1979 296 p Hearings before the Subcomm. on Energy Develop. and Appl. of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., no. 26, 4 May and 2 Jun. 1979
(GPO-49-650) Avail: SOD HC

The production of alcohol from agricultural products and wastes is discussed. Establishing a federal policy concerning alcohol fuel as a substitute for imported oil was being considered. L.F.M.

N81-13180# Committee on Science and Technology (U. S. House).
OVERSIGHT. OTA'S STUDY: THE DIRECT USE OF COAL, VOLUME 2
Washington GPO 1979 245 p refs Hearing before the Subcomm. on Energy Develop. and Appl. of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., no. 22, 3 May 1979
(GPO-47-453) Avail: SOD HC

An assessment is made of the benefits and risks of a massive shift to the use of coal. It deals with the social, economic, physical, and biological impacts of such a shift. It examines the complete coal system from extraction to combustion, including the key steps and institutions that policy can influence. The environmental impacts and possible effects on the public health are documented. L.F.M.

N81-13181# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
INFLUENCE OF MICO FUELS ON ENGINE PERFORMANCE, EXHAUST EMISSIONS, AND ENDURANCE Interim Report
K. Tataiah and S. J. Lestz Dec. 1979 87 p refs
(Contracts DAAK70-78-C-0001; DAAK70-80-C-0001)
(AD-A090977; AFLRL-125) Avail: NTIS HC A05/MF A01 CSCL 21/4

The influence of Micronized Coal-in-Oil (MICO) fuels on engine performance and exhaust emissions was experimentally studied in a single cylinder Hatz diesel engine. One of these fuels, which contained 20 wt% coal, was also examined for its effects on engine endurance and wear in a four cylinder Mercedes diesel engine. The performance and emissions tests were conducted at twelve different steady-state conditions covering the operating speed-load range of the engine. In each test, the exhaust emissions (including particulates, sulfates, and smoke), crankcase blowby, and temperatures were measured, and brake thermal efficiency and air-fuel ratio was calculated. The results obtained with the single cylinder engine indicate that the coal in MICO fuel hinders the combustion of the diesel component and decreases the overall brake thermal efficiency of the engine. Although the coal reduces the consumption of diesel fuel component, the total energy consumption is higher. GRA

N81-13182# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
DEVELOPMENT OF ARMY HIGH ENERGY FUEL FOR DIESEL/TURBINE POWERED SURFACE EQUIPMENT Interim Technical Report, Oct. 1977 - Oct. 1979
William W. Wimer and Edwin C. Owens Oct. 1979 119 p refs
(Contracts DAAK70-78-C-0001; DAAK70-80-C-0001; DA Proj. 1L7-62733-AH-20)
(AD-A091318; AFLRL-120) Avail: NTIS HC A06/MF A01 CSCL 21/4

This is a status report on the U.S. Army's ongoing program on high energy fuels for diesel/turbine powered surface equipment. The Army is interested in those fuels that have a high energy content per unit volume and therefore result in increased payload capabilities and/or extended operational range of their vehicles. Two types of high energy fuels are discussed in this report. The first being the synthetic liquid hydrocarbon fuels of the polycondensed cycloparaffinic type; the second being the powdered solids/hydrocarbon slurries. Background information is provided on several of the synthetic liquid hydrocarbon fuels; the Air Force's and the Navy's interests in these fuels are discussed; and a brief review of their chemistry and properties are included. Examples of these fuels are JP-9, JP-10 (exo-tetrahydrodicyclopentadiene), and RJ-5. Background material is also provided on various carbonaceous materials considered for use in slurry preparation. The selection of the carbons to be used along with their properties, are described. Also discussed are the mixing devices used in the preparation; the various dispersants considered; the stability of the various slurries; and the methods and techniques for measuring their settling rates and determining their stability. GRA

N81-13183# Sandia Labs., Albuquerque, N. Mex. Systems Analysis.
CONSIDERATION FOR BIOMASS ENERGY SYSTEMS
Charles C. Carson and Carolyne M. Hart May 1980 80 p refs Sponsored by DOE
(SAND-80-0073) Avail: NTIS HC A05/MF A01

Several different biomass forms, or feedstocks, contribute to the total potential for biomass energy. A summary of the energy potentials of the U.S. biomass resource base is presented along with a survey of existing thermochemical and biochemical processes for converting the feedstocks into usable energy products. Energy requirements, economics, and alternate uses for biomass resources are included in the discussion. It is concluded that the current biomass resources could provide up to 2.5 EJ of usable energy and that with a concentrated, long-term program this contribution could grow to between 10 and 15 EJ. The biomass feedstock with the largest potential is wood, which provides more than half of the estimated total. DOE

N81-13184# Westinghouse Electric Corp., Pittsburgh, Pa. Advanced Energy Systems Div.
SYSTEM SAFETY REPORT FOR METHANE UTILIZATION FROM COALBEDS FOR POWER GENERATION AT BETHLEHEM MINES CORPORATION MARIANNA MINE NO. 58, MARIANNA, PENNSYLVANIA
Jul. 1980 57 p
(Contract DE-AC21-77ET-13133)
(AESD-TME-3030) Avail: NTIS HC A04/MF A01

Hazards associated with the coalbed gas mixture program are identified and equipment, systems and procedures that would eliminate, control or provide early warning of these potential hazards is specified. Flammable gases are compressed safely every day and there are many installations of turbine generator units running on liquid fuel or natural gas. As the primary potential hazard of this program is in the utilization of a methane air mixture, which in the percentage range of 5 to 15 percent is highly flammable, the major system safety engineering effort is directed towards this mixture's safe control. It can be utilized by not allowing it to approach its limits or flammability until it is in the turbine system and by controlling extraneous sources of ignition. S.F.

N81-13185# Fluor Engineers and Constructors, Inc., Irvine, Calif.
ENTRAINED GASIFICATION COMBINED CYCLE CONTROL STUDY, VOLUME 1. SUMMARY OF RESULTS AND CONCLUSIONS Final Report
J. Clark, L. Denton, M. Hashemi, J. Joiner, S. Smelser, C. Chowaniec, M. Hobbs, S. Jennings, and E. Phelts Jun. 1980 119 p Prepared in cooperation with Westinghouse Electric Corp., Concordville, Pa.
(EPRI Proj. 913-1)
(EPRI-AP-1422-Vol-1) Avail: NTIS HC A06/MF A01

Two control strategies are evaluated for an entrained coal gasifier fueling a gas turbine/steam turbine combined-cycle power plant which was simulated by computer. Transient operation of this gasification-combined-cycle (GCC) plant was studied to determine open-loop response as a stand-alone plant, as well as closed-loop response while functioning in a typical utility power system. The GCC plant may be controlled satisfactorily in either gasifier-lead or turbine-lead control mode. The absorber column consistently removed 90% of the hydrogen sulfide (H2S) in the raw fuel gas produced from high sulfur Illinois coal during the closed loop control runs. GCC plant pressure control must be installed to minimize plant pressure transients of the absorber column in the acid gas removal unit. The local controllers adequately maintained the GCC plant operation during all the emergency upsets examined. Supplemental fuel gas storage is not required. The design and operating characteristics of the oxygen plant can affect the response time of the GCC plant. DOE

N81-13186# Mueller Associates, Inc., Baltimore, Md.
POTENTIAL SOURCES OF NON-PETROLEUM BASED ALCOHOLS FOR VEHICULAR FLEET TESTING
Dec. 1979 23 p refs
(Contract EX-76-C-01-2098)
(DOE/CS-56051/2) Avail: NTIS HC A02/MF A01

The commercialization of alternative fuels as a supplement to or replacement for petroleum based fuels is considered. Fuel fleet tests are described which are to employ alcohol/gasoline blends. The prospects of obtaining these alcohols from nonpetroleum/nonnatural gas feedback is discussed in terms of fuel efficiency and cost. A number of sources are described from which methanol and ethanol can be obtained. R.C.T.

N81-13187# Dynatech Corp., Cambridge, Mass.
LIQUID FUELS PRODUCTION FROM BIOMASS Progress Report, 1 Jul. - 30 Sep. 1979
J. E. Sanderson, D. L. Wise, P. F. Levy, and M. S. Molyneaux 15 Oct. 1979 33 p refs
(Contract EG-77-C-02-4388)
(COO-4833-9; PR-8; Rept-1956) Avail: NTIS HC A03/MF A01

A current program to convert biomass into liquid hydrocarbon fuels is described. It it shown that marine algae could be converted to higher aliphatic organic acids and that these acids could be readily removed from the fermentation broth by membrane or liquid-liquid extraction. It is also shown that these higher organic acids can be converted to aliphatic hydrocarbons via Kolbe Electrolysis, which may be used as a diesel fuel. R.C.T.

N81-13188# Mueller Associates, Inc., Baltimore, Md.
BIOMASS AS A FEEDSTOCK FOR HIGHWAY VEHICLE FUELS: A RESOURCE AND AVAILABILITY SURVEY
Dec. 1979 54 p refs
(Contract EX-76-C-01-2098)
(DOE/CS-56051/1) Avail: NTIS HC A04/MF A01

The use of biomass as a feedback for highway vehicle transportation fuels (alcohols) is addressed. The scope is limited to aggregate, nationwide supply aspects without consideration for overall system economics or the availability of alcohol processing facilities (which, of course, would be major factors that would affect the implementation of biomass based transportation fuels). A first ordered estimate is presented of the range of alcohol fuels that could be produced (again, from strictly a supply viewpoint) based on known biomass availability and with consideration for land use limitations, time factors and technology improvements. R.C.T.

N81-13189# Los Alamos Scientific Lab., N. Mex.
THERMAL RESPONSE OF SPHERICAL EXPLOSIVE CHARGES SUBJECTED TO EXTERNAL HEATING
Dwight L. Jaeger Aug. 1980 11 p refs
(Contract W-7405-eng-36)
(LA-8332) Avail: NTIS HC A02/MF A01

A series of one dimensional heating experiments was performed with selected high explosives (HEs) in unconfined spherical geometries. The thermal behavior of HE specimens near their ignition temperature was studied and the accuracy with which the Arrenius kinetics models can simulate the ignition process was examined. All test samples were instrumented with thermocouples and the time temperature data were recorded on a flexible disk. Comparisons between analytical predictions and test data show that the explosives go through a solid state induction process before the Arrhenius models describe their behavior effectively, the explosives have a memory of the induction process, and the Arrhenius model can accurately predict the critical temperature but not necessarily the time to ignition. DOE

N81-13190# Delaware Univ., Newark. Dept. of Chemistry.
DEVELOPMENT OF UNIQUE CATALYSTS FOR HYDRODENITROGENATION OF COAL-DERIVED LIQUIDS Quarterly Report, 15 Sep. - 15 Dec. 1979
James R. Katzer, Alvin B. Stiles, and Harold Kwart 1 Feb. 1980 46 p
(Contracts DE-AS01-78ET-03297; ET-78-5-01-3297)
(FE-3297-5; AR-5) Avail: NTIS HC A03/MF A01

Several catalysts were prepared with the objective of developing new hydrodenitrogenation catalysts which would selectively coordinate the nitrogen atom and remove it without hydogenating the entire ring. Catalysts prepared by coprecipitation and by impregnation were compared for their nitrogen removal rates, using decahydroquinoline as the reactant. The catalyst prepared by coprecipitation removed nitrogen much more quickly than the impregnation-type catalyst. From these results and using the criteria of chemical and mathematical feasibilities, a network for the hydrodenitrogenation of decahydroquinoline was hypothesized and is presented. DOE

N81-13191# Chevron Research Co., Richmond, Calif.
REFINING AND UPGRADING OF SYNFUELS FROM COAL AND OIL SHALES BY ADVANCED CATALYTIC PROCESSES Quarterly Report, Jan. - Mar. 1980
R. F. Sullivan and D. J. ORear Mar. 1980 41 p
(Contract EX-76-C-01-2315)
(FE-2315-52) Avail: NTIS HC A03/MF A01

Asphaltenelike impurities in the Illinois and Wyodak H-Coal syncrudes were found to have a large effect on the performance of the hydrotreating catalyst which upgrades these syncrudes to jet or diesel fuels. When these impurities are removed by redistilling the syncrudes, the space rate of the Illinois H-Coal syncrude hydrotreater can be increased from 0.5 to 1.5 with constant product quality and catalyst performance. After hydrotreating, a small amount of 600 F + oil in the products from the whole H-Coal syncrudes made the products fail several jet fuel tests: gravity, gum content, end point, and occasionally freeze point. When the 600 F + oil was removed, either by distilling the syncrude or hydrotreated product, these specifications were met. DOE

N81-13192# Department of Energy, Washington, D. C. Energy Information Administration.
CRUDE PETROLEUM, PETROLEUM PRODUCTS, AND NATURAL GAS LIQUIDS, 1978 Final Report
Nov. 1979 38 p
(DOE/EIA-0108/78) Avail: NTIS HC A03/MF A01

Production of crude petroleum (including lease condensate) in the United States in 1978 averaged 8,707,000 barrels per day, an increase of 5.6% above 1977 levels. Imports of crude petroleum in 1978 averaged 5,356,000 barrels per day, 3.9% lower than the previous year. Thirty-two tables are presented which demonstrate the contrast between domestic energy production and the importation of foreign fuel stocks. R.C.T.

N81-13193# Sandia Labs., Albuquerque, N. Mex.
KINETICS AND MECHANISMS OF THE HYDROLIQUEFACTION OF COAL: ILLINOIS NO. 6, BURNING STAR COAL

IN SRC-2 HEAVY DISTILLATE
M. G. Thomas and T. C. Dickel 1980 13 p refs
(SAND-80-0232C; CONF-800929-1) Avail: NTIS HC A02/MF A01

The study was conducted to obtain rates of reaction and activation energies for one coal - Illinois no. 6, Burning Star high volatile bituminous coal and one solvent - coal process derived SRC-11 Heavy Distillate (450 to 850 F distillation range). Coal to solvent ratio, reaction time, temperature, and pressure are variables in a parametric study between 275 C and 475 C. Two different types of reactors were employed, a microreactor system for screening and a continuous flow reactor for the derivation of kinetic data. No attempt to generalize the results is made. L.F.M.

N81-13194# Sandia Labs., Albuquerque, N. Mex.
COAL LIQUEFACTION PROCESS RESEARCH Quarterly Report, Jan. - Mar. 1980
T. C. Bickel, R. M. Curlee, B. Granoff, T. D. Padrick, F. V. Stohl, and M. G. Thomas 1980 59 p refs Sponsored by DOE
(SAND-80-1426) Avail: NTIS HC A04/MF A01

Coal liquefaction is discussed in order to provide a fundamental understanding of the process. Studies of three major subjects are presented: short-contact-time coal liquefaction, mineral effects, and catalyst studies. The tasks associated with each are outlined prior to a discussion of specific accomplishments. L.F.M.

N81-13195# Oak Ridge National Lab., Tenn.
FUELS AND CHEMICALS FROM WOODY BIOMASS PROGRAM, SUMMARY. CONTRACTOR REPORTS Quarterly Progress Report, Sep. - Dec. 1979
1979 93 p
(Contract W-7405-eng-26)
(DOE/TIC-11254; QPR-6) Avail: NTIS HC A05/MF A01

Species selection, stand establishment, cultural treatments and management alternatives are discussed. Harvest, collection, transport, and storage are described. DOE

N81-13196# Institute of Gas Technology, Chicago, Ill.
PREPARATION OF A COAL CONVERSION SYSTEMS TECHNICAL DATA BOOK Quarterly Report, 1 Aug. - 31 Oct. 1979
Sep. 1980 397 p
(Contract DE-AC01-76ET-10255)
(FE-2286-56) Avail: NTIS HC A17/MF A01

Coal storage, handling, and preparation are discussed. The Data Book format was used. DOE

N81-13197# United Technologies Research Center, East Hartford, Conn.
PHYSICAL AND CHEMICAL CHARACTERIZATION OF COAL Final Report, May 1978 - Jan. 1980
D. G. Hamblen, P. R. Solomon, and R. H. Hobbs May 1980 163 p refs
(Contract EPA-68-02-3116)
(PB80-220775; EPA-600/7-80-106) Avail: NTIS HC A08/MF A01 CSCL 21D

An automated scanning electron microprobe method of analyzing sulfur forms and mineral matter in coal is described. The microprobe was used to measure the spatial distribution of a number of elements on a scale where individual grains can be observed. These data were then analyzed to extract the following information: organic sulfur concentration; mineral sulfur concentration; total sulfur concentration; major mineral concentrations; and stoichiometry of iron sulfide. The procedure is fully automated: all of the above information was obtained on a 200 mg coal sample in less than 15 minutes. GRA

N81-13198# Schnittker Associates, Washington, D.C.
ETHANOL: FARM AND FUEL ISSUES
Aug. 1980 160 p
(PB80-215692; NAFC-80-04) Avail: NTIS HC A08/MF A01 CSCL 21D

The current U.S. and world grain situations are described as well as adjustments which would be likely for fuel production of 1,2 and 4 billion gallons of ethanol annually in the 1985-86 period. Predicted acreage shifts in corn, soybeans, wheat and the total of seven major crops are shown. The most likely effects on the feed grains markets both here and abroad are discussed. The value of corn for fuel both with and without the gasoline tax exemption is compared to the actual farm price expected if in the base case (1 billion gallons) real corn prices do not rise. In the higher 2 and 4 billion gallon cases, increases in the real cost of corn and its impact on food prices and the CPI are estimated. GRA

N81-13199# Woodard-Clyde Consultants, San Francisco, Calif.
ASSESSMENT OF POTENTIAL ENVIRONMENTAL IMPACTS OF GEOPRESSURED METHANE DEVELOPMENT Final Report, Jul. 1979 - Mar. 1980
Kamal Golabi Mar. 1980 300 p refs Prepared in cooperation with ESCOR, Inc., Northfield, Ill. Sponsored by Gas Research Inst.
(PB80-210701; GRI-79/0025) Avail: NTIS HC A13/MF A01 CSCL 10A

A critical examination of available information on the characteristics of geopressured methane resources is presented. Potential environmental impacts and regulatory constraints that may influence the development and commercial use of the resource are assessed. Issues unique to geopressured methane development are defined. A list of recommendations for planning future research efforts is given. GRA

N81-13200# Institute of Gas Technology, Chicago, Ill.
THERMOCHEMICAL HYDROGEN PRODUCTION Annual Report, 1979
Stephen E. Foh, James D. Schreiber, Jon B. Pangborn, and Thomas P. Whaley May 1980 193 p refs
(Contract GRI-5014-323-0017)
(PB80-210776; GRI-80/0039) Avail: NTIS HC A09/MF A01 CSCL 21D

Chemical cycle development for water splitting to produce hydrogen and oxygen advanced through research on sequences of thermochemical and electrochemical reactions. One of the reaction sequences or cycles is based on copper oxide and sulfate chemistry, a similar one uses zinc chemistry, and one is a solar energy cycle that uses cadmium chemistry. The most promising copper cycle was demonstrated in the laboratory with recycled materials, and the zinc sulfate cycle was improved in energy efficiency through a procedure that decreases thermal separation requirements. The electrochemical step of the cadmium cycle achieved efficient operation at low voltage potentials. GRA

N81-13201# Massachusetts Inst. of Tech., Cambridge. LNG Research Center.
LIQUEFIED NATURAL GAS GELS: STRUCTURE, RHEOLOGY, AND PRODUCTION ENERGY REQUIREMENTS Final Report, Jan. 1976 - Dec. 1979
Robert C. Reid, Lucile M. Shanes, and Preetinder S. Virk Dec. 1979 81 p refs
(Contract GRI-5010-352-0011)
(PB80-210685; GRI-77/0012) Avail: NTIS HC A05/MF A01 CSCL 21D

Liquefied natural gas was gelled with two gelants, water and methanol, using a vapor condensation technique. Gelant particle structure analysis, by X-ray diffraction, composition determination and microscopic observation showed that the particles were crystalline clathrate solids with hydrogen bonding between gel particles likely responsible for the observed gel structure. LNG gels offer safety benefits in transporting natural gas. Measurements of LNG gel vaporization from a water surface showed that the gels boiled at rates about one-half those of normal LNG. With rheological data used to predict gel spreading behavior, it was estimated that a typical gel could reduce the maximum distance for flammable mixtures fivefold. GRA

N81-13202# Massachusetts Inst. of Tech., Cambridge. LNG Research Center.
ELECTROSTATIC CHARGE GENERATION IN HYDROCARBON LIQUIDS Final Report, Jan. 1978 - Aug. 1979
Peter M. Hirsch and Kenneth A. Smith Jun. 1980 133 p refs
(Contract GRI-5010-352-0011)
(PB80-210768; GRI-80/001) Avail: NTIS HC A07/MF A01 CSCL 21D

A coaxial cylinder flow generator which contains the test

fluid was developed. It is geometrically similar to a Couette viscometer. The electrically grounded, inner metal cylinder (bob) was rotated within an electrically floating metal cup. The induced charge was measured as the electrical potential difference across a capacitor attached to the cup wall. The charging potential was measured as a function of the bob speed, the width of the annulus, and the electrical conductivity of the hydrocarbon liquid. Potentials in the range of 0.1 to 100 volts were obtained. The charging potential was found to increase approximately linearly with bob speed and with gap width, and to decrease approximately as the square root of the conductivity. GRA

N81-13203# Institute for Defense Analyses, Arlington, Va. Program Analysis Div.
PAPERS, RELATED TO GASOLINE SUPPLY, MISFUELING AND ENVIRONMENTAL AIR QUALITY FOR THE SUMMER OF 1979 Final Report
D. Dacy, P. Cutchis, F. Giertz, R. Kuenne, J. Magnin, R. Oliver, and H. Steele Oct. 1979 170 p refs
(Contract EPA-68-01-5150)
(PB80-212798; IDA-P-1445) Avail: NTIS HC A08/MF A01 CSCL 21D

Nine back-up essays to the study, 'Analysis of Options to Limit Air Quality Degradation Due to Misuse of Leaded Gasoline in Cars Equipped with Catalytic Converters,' IDA P-1426 are presented. The essays pertain to the problem of 'misfueling' which was a prominent feature of the gasoline shortage in the summer of 1979. GRA

N81-13204# Institute for Defense Analyses, Arlington, Va. Program Analysis Div.
ANALYSIS OF OPTIONS TO LIMIT AIR QUALITY DEGRADATION DUE TO MISUSE OF LEADED GASOLINE IN CARS EQUIPPED WITH CATALYTIC CONVERTERS
D. Dacy, P. Cutchis, R. Kuenne, J. Magnin, and R. Oliver Oct. 1979 67 p refs
(Contract EPA-68-01-5150)
(PB80-212780; IDA-P-1426) Avail: NTIS HC A04/MF A01 CSCL 21D

Three short term and eight intermediate term options to limit the use of leaded gasoline in cars equipped with catalytic converters are analyzed. The short term options analyzed are: (1) mandated price differential between leaded and unleaded gasoline; (2) temporary suspension of ban on the additive MMT; and (3) increased lead use in leaded gasoline. The intermediate term options analyzed are: (1) delay in introducing the three way catalytic converter; (2) tax subsidy schemes; (3) closing down self-service stations; (4) federal law against misfueling; (5) inspection-down self-service stations; (6) public relations program; (7) gasoline rationing; and (8) use of additives and blending materials to increase supply of unleaded gasoline. GRA

N81-13205# Battelle Columbus Labs., Ohio.
PRETREATMENT METHODS FOR THE DEGRADATION OF LIGNIN Final Report
Billy R. Allen, Michael J. Cousin, and George E. Pierce Mar. 1980 189 p refs
(Grant NSF PFR-77-25833)
(PB80-209323; NSF/RA-800062) Avail: NTIS HC A09/MF A01 CSCL 21D

Seven classes of pretreatment processes were identified in the literature review: physical pretreatments; thermal pretreatments; alkaline pretreatments; acidic pretreatments; delignification; cellulose solvents; and biological pretreatments. Cost estimates for ten of the processes were obtained. The pretreatments offering the most promise are autohydrolysis; explosive depressurization; dilute sulfuric acid; concentrated hydrochloric acid; organosolv; and cellulose solvents. The pretreatments address the critical problem of separating the major components so that each can be further processed into useful products. GRA

N81-13206# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.
NATIONAL EMISSIONS DATA SYSTEM (NEDS) FUEL USE REPORT (1977) Final Report
Mar. 1980 127 p
(PB80-212723; EPA-450/4-80-004) Avail: NTIS HC A07/MF A01 CSCL 21D

Annual estimates of total consumption of major fuels such as coal, fuel oil, natural gas, gasoline, and diesel fuel. Estimates of the consumption of a number of other comparatively minor fuels are also included. The data are distributed according to major categories of air pollutant emissions sources and are reported for the nation as a whole and for individual states, territories, and the District of Columbia. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N81-13207 Oklahoma Univ., Norman.
NUMERICAL ANALYSIS OF CERTAIN CONSTRAINED OPTIMIZATION PROBLEMS IN NONLINEAR MECHANICS Ph.D. Thesis
Akio Satake 1980 126 p
Avail: Univ. Microfilms Order No. 8027530

The first problem is concerned with elastic-plastic torsion of a bar subjected inequality constraints on the gradient of the stress function. The variational inequality approach was used in the formulation and numerical solution of the problem. It is concluded that the variational inequality approach is numerically accurate and computationally efficient. Several noncircular and nonrectangular cross section bars were used to show the stress contours and elasto-plastic interface as a function of the twisting couple. The second problem is concerned with the natural convection of a laminar incompressible Newton fluid in enclosures. The divergence free condition on the velocity field is treated as a constraint. The penalty function method was employed to formulate the problem, and the finite element method was used to solve the problem numerically. A finite element based on the stream function vorticity formulation was also developed to assess the accuracy and computational simplicity of the penalty finite element developed. The study indicates the penalty-finite element is computationally less expensive, while yielding competitively accurate solutions for moderately high Rayleigh numbers.
Dissert. Abstr.

N81-13208 State Univ. of New York, Buffalo.
PERFORMANCE REPRESENTATION AND OPTIMIZATION OF ELECTRICAL DISCHARGE MACHINING Ph.D. Thesis
Vaidyanathan Raghunathan 1980 213 p
Avail: Univ. Microfilms Order No. 8027628

Performance measures and significant machining parameters were identified for the particular combination of tool, workpiece and power supply. Existing optimization techniques were used to optimize the process maximizing the machining rate under constraints of surface roughness and tool wear. Trade off curves were developed showing the maximum machining rate possible as a function of allowable surface roughness. Relative tool wear was not found to be an active constraint for the tool and workpiece combination of this study. An approximate scheme, based on the optimization results is presented. It may be used by a production engineer to quickly optimize new machining configurations and/or new materials. Adaptive control possibilities in Electrical Discharge Machining were briefly reviewed.
Dissert. Abstr.

N81-13209 Northwestern Univ., Evanston, Ill.
NONLINEAR RESPONSE OF PLAIN CONCRETE AND CRACKED REINFORCED CONCRETE Ph.D. Thesis
Tatsuya Tsubaki 1980 192 p
Avail: Univ. Microfilms Order No. 8026937

Several interrelated aspects are of the nonlinear behavior of plain concrete and reinforced concrete that are caused or strongly influenced by cracking or microcracking are investigated. A numerically effective, yet realistic mathematical model is proposed for each nonlinear aspect. The nonlinear response due to densely distributed continuous cracks in plain concrete and reinforced concrete, caused mainly by predominantly tensile loading, is considered first. The nonlinear response to predominantly compressive loading which only produce discontinuous, densely distributed microcracks in concrete is considered next. Finally,

the time dependent nonlinear response, on nonlinear creep the cause of which consists mainly in general microcracking is considered. Dissert. Abstr.

N81-13210*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE TELECOMMUNICATIONS AND DATA ACQUISITION Progress Report, Sep. - Oct. 1980
N. A. Renzetti, ed. 15 Dec. 1980 190 p refs
(NAS7-100)
(NASA-CR-163814; JPL-PR-42-60) Avail: NTIS HC A09/MF A01 CSCL 05A

Radio astronomy and radio interferometry at microwave frequencies are discussed. Other topics concerning the Deep Space Network include program planning, planetary and interplanetary mission support, tracking and ground based navigation, communications, and station control and system technology. For individual titles, see N81-13211 through N81-13232.

N81-13211*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RADIO ASTRONOMY c89
R. M. Taylor and R. N. Manchester (CSIRO, Sydney) *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 1-5 (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 03A

The activities of the Deep Space Network in support of radio and radar astronomy operations during July and August 1980 are reported. A brief update on the OSS-sponsored planetary radio astronomy experiment is provided. Also included are two updates, one each from Spain and Australia on current host country activities. E.D.K.

N81-13212*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ORION MOBILE UNIT DESIGN c46
D. L. Brunn, S. C. Wu, E. H. Thom, F. D. McLaughlin, and B. M. Sweetser *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 6-32 refs (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 08G

An overview of the design of the ORION mobile system is presented. System capability and performance characteristics are outlined. Functional requirements and key performance parameters are stated for each of the nine subsystems. A master design and implementation schedule is given. Author

N81-13213*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
LIFE-CYCLE COST ANALYSIS TASK SUMMARY c83
M. McKenzie *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 33-43 ref (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 05C

The DSN life cycle cost (LCC) analysis methodology was completed. The LCC analysis methodology goals and objectives are summarized, as well as the issues covered by the methodology, its expected use, and its long range implications. E.D.K.

N81-13214*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VOYAGER MISSION SUPPORT (2) c91
N. Fanelli and H. E. Nance *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 44-59 refs (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 03B

The Deep Space Network report on tracking and data acquisition for Voyager Project is continued. The period of August through October 1980 is covered. The use of beacons for interplanetary navigation, specifically for target related navigation, was shown to be of significant value. E.D.K.

N81-13215*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DIFFERENTIAL VERY LONG BASELINE INTERFEROMETRY (DELTA VLBI) SPACECRAFT TRACKING SYSTEM DEMONSTRATION. PART 2: DATA ACQUISITION AND PROCESSING c17
C. S. Christensen, B. Moultrie, P. S. Callahan, F. F. Donivan, and S. C. Wu *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 60-67 refs (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 22A

A set of experiments in the use of Differential Very Long Baseline Interferometry (delta VLBI) for spacecraft navigation were completed. Data using both Voyager spacecraft and a single quasar were acquired during the Jupiter encounter time period. The data were processed and analyzed to assess the navigation accuracy of delta VLBI. The data reduction and techniques for assessing data quality and consistency are discussed. E.D.K.

N81-13216*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CAPACITY, CUTOFF RATE, AND CODING FOR A DIRECT-DETECTION OPTICAL CHANNEL c32
J. L. Massey (Swiss Federal Technical Univ., Zurich) *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 68-76 refs (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 17B

It is shown that Pierce's pulse position modulation scheme with 2 to the L pulse positions used on a self-noise-limited direct detection optical communication channel results in a 2 to the L-ary erasure channel that is equivalent to the parallel combination of L completely correlated binary erasure channels. The capacity of the full channel is the sum of the capacities of the component channels, but the cutoff rate of the full channel is shown to be much smaller than the sum of the cutoff rates. An interpretation of the cutoff rate is given that suggests a complexity advantage in coding separately on the component channels. It is shown that if short-constraint-length convolutional codes with Viterbi decoders are used on the component channels, then the performance and complexity compare favorably with the Reed-Solomon coding system proposed by McEliece for the full channel. The reasons for this unexpectedly fine performance by the convolutional code system are explored in detail, as are various facets of the channel structure. Author

N81-13217*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A PROTOTYPE DSN X/S-BAND FEED: DSS 13 APPLICATION STATUS c32
W. Williams and H. Reilly *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 P 77-88 refs (For primary document see N81-13210 04-31)
(Rept-4) Avail: NTIS HC A09/MF A01 CSCL 20N

A prototype X/S-band common aperture horn feed for future use at various DSN sites and the Network Consolidation Program is discussed. The final design and fabrication of the second generation feedhorn and combiner is dealt with. The results of the measurements obtained with the second generation, full scale feed configuration are presented. E.D.K.

N81-13218*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A 20-kW X-BAND UPLINK TRANSMITTER DEVELOPMENT c32
R. B. Kolbly *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 89-95 ref (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 17B

The 20 kW X-band transmitter power amplifier and its related control and monitor cabinet are described. The circuitry for the monitoring and protection of various transmitter components is discussed. E.D.K.

N81-13219*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A NOTE ON THE R SUb 0-PARAMETER FOR DISCRETE MEMORYLESS CHANNELS c61
R. J. McEliece *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 96-97 ref (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 09B

An explicit class of discrete memoryless channels (q-ary erasure channels) is exhibited. Practical and explicit coded systems

of rate R with R/R sub o as large as desired can be designed for this class. E.D.K.

N81-13220*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
INTERLEAVED BLOCK CODES FOR THE PHOTON CHANNEL c32
R. J. McEliece *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 98-102 refs (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 17B

It is shown that interleavel binary block codes combined with pulse position modulation give the best practical coded systems yet devised for optical communication with photon detection. Linear block codes rather than convolutional codes are considered. E.D.K.

N81-13221*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RFI CHANNELS c32
R. J. McEliece *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 103-106 refs (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 17B

A class of channel models is presented which exhibit varying burst error severity much like channels encountered in practice. An information-theoretic analysis of these channel models is made, and conclusions are drawn that may aid in the design of coded communication systems for realistic noisy channels. E.D.K.

N81-13222*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TEMPERATURE CONTROL SIMULATION FOR A MICROWAVE TRANSMITTER COOLING SYSTEM c33
C. S. Yung *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 107-120 refs (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 09C

The thermal performance of a temperature control system for the antenna microwave transmitter (klystron tube) of the Deep Space Network antenna tracking system is discussed. In particular the mathematical model is presented along with the details of a computer program which is written for the system simulation and the performance parameterization. Analytical expressions are presented. M.G.

N81-13223*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
IMPLEMENTING THE UCSD PASCAL SYSTEM ON THE MODCOMP COMPUTER c61
T. Wolfe *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 121-125 refs (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 09B

The implementation of an interactive software development system (UCSD PASCAL) on the MODCOMP computer is discussed. The development of an interpreter for the MODCOMP II and the MODCOMP IV computers, written in MODCOMP II assembly language, is described. The complete Pascal programming system was run successfully on a MODCOMP II and MODCOMP IV under both the MAX II/III and MAX IV operating systems. The source code for an 8080 microcomputer version of the interpreter was used as the design for the MODCOMP interpreter. A mapping of the functions within the 8080 interpreter into MODCOMP II assembly language was the method used to code the interpreter. M.G.

N81-13224*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
X-BAND, LOW-NOISE, TRAVELING-WAVE MASER c36
D. L. Trowbridge *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 126-131 refs (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 20E

The development and performance of X-band traveling-wave maser (TWM) systems with effective input noise temperature of 3.5 K and bandwidths varying from 65 to 108 MHz is discussed. These TWMs are used on the 64-meter antennas at Deep Space Stations 14, 43 and 63 at 8420 MHz to meet the requirements of the Voyager-Saturn encounter. The TWMs use shortened and cooled signal input waveguide to reduce noise and are equipped with superconducting magnets and solid-state pump sources to provide the required stability performance. M.G.

N81-13225*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DSS COMMAND SOFTWARE UPDATE c61
W. G. Stinnett *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 132-134 (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 09B

The modifications, additions, and testing results for a version of the Deep Space Station command software, generated for support of the Voyager Saturn encounter, are discussed. The software update requirements included efforts to: (1) recode portions of the software to permit recovery of approximately 2000 words of memory; (2) correct five Voyager Ground data System liens; (3) provide capability to automatically turn off the command processor assembly local printer during periods of low activity; and (4) correct anomalies existing in the software. M.G.

N81-13226*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RFI PREVENTION FOR COLOCATED ANTENNAS c32
T. K. Peng *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 135-144 refs (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 20N

Potential radio frequency interference problems related to the colocation of antennas for the Mark 4-A Deep Space network are analyzed. Cases discussed include effects of S-band uplinks on X-band downlinks and S-band downlinks, planetary radar at Goldstone, future X-band uplink, radiometer measurements, Search for Extraterrestrial Intelligence instrument, and radio astronomy projects. Remedial actions are suggested. M.G.

N81-13227*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PROTOTYPE REAL-TIME BASEBAND SIGNAL COMBINER c32
L. D. Howard *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 145-151 refs (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 17B

The design and performance of a prototype real-time baseband signal combiner, used to enhance the received Voyager 2 spacecraft signals during the Jupiter flyby, is described. Hardware delay paths, operating programs, and firmware are discussed. M.G.

N81-13228*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE MICROPROCESSOR-BASED SYNTHESIZER CONTROLLER c60
M. R. Wick *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 152-154 refs (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 09B

Implementation and performance of the microprocessor-based controllers and Dana Digiphase Synthesizer (DCO) installed in the Deep Space Network exciter in the 64-meter and 34-meter subnets to support uplink tuning required for the Voyager-Saturn Encounter is discussed. Test data in tests conducted during the production of the controllers verified the design objective for phase control accuracy of 10 to the - 12 power cycles in eight hours during ramping. Tests conducted require a phase error between a theoretical calculated value and the actual phase of no greater than + or - 1 cycle. Tests included (1) a ramp over a period of eight hours using a ramp rate which covers the synthesizer tuning range (40-51 MHz) and (2) a ramp sequence using the maximum rate (+ or kHz/s) over the tuning range. M.G.

N81-13229*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
BLOCK 4 RECEIVER TRACKING LOOP PERFORMANCE IN

THE PRESENCE OF A CW RFI **c32**
M. K. Sue *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 155-167 refs (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 20N

A model that allows one to predict the tracking performance of the Block 4 receiver in the presence of a continuous wave radio frequency interference is discussed. Experimental and analytical results are provided for a typical Deep Space Network operational mode. Simulation and experimental results show good agreement with theoretical prediction for the static phase error and out-of-lock values. Predicted phase jitter is consistently lower than the experimental and simulated results by a factor of one-half for small interference to signal ratio (ISR) when the offset frequency is small. For large ISR, good agreement is observed. The analytical model assumes a noiseless condition, which is valid only when the loop is operated at strong signal levels. Experimental data indicate, however, that even at the minimum operating signal level of 10-dB carrier margin, reasonably good prediction can still be obtained. A curve of protection criteria that extends the current recommendation is also presented. M.G.

N81-13230*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RADIO FREQUENCY PERFORMANCE OF DSS 14 64-METER ANTENNA AT X-BAND USING AN IMPROVED SUBREFLECTOR **c32**
A. J. Freiley *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 168-176 refs (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 20N

The performance of the Deep Space Station (DSS) 14 64-meter antenna X-band gain determined using the X- and K-band Radar feedcone is discussed. Tests prior to, and following the installation of an improved subreflector, proved the unit largely (if not totally) restored initial performance levels at that station. The X-band peak gain with the subreflector is +17.8dBi(area efficiency of 47.3 percent); an increase of +0.47 dB due to the unit installation. The test further showed a significant shift in the axial focus required (function of elevation angle) which, if not implemented operationally, will cause a serious degradation. An historical summary of all documented X-band gain measurements at DSS 14 is included and reviewed. The initial performance is traced through various major configuration changes such as the installation of the X-band dual hybrid mode horn within the operational XRO feedcone. Finally, based on the summary and recent data, a peak X-band antenna gain of +72.1 dBi (area efficiency of 50.8 percent) is projected for the operational feedcone. M.G.

N81-13231*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GOLDSTONE RADIO SPECTRUM PROTECTION **c32**
B. A. Gaudian and R. B. Cushman (Bendix Field Engineering Corp.) *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 177-182 (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 17B

Potential electromagnetic interference to the Goldstone tracking receivers due to neighboring military installations is discussed. Coordination of the military and NASA Goldstone activities in the Mojave Desert area is seen to be an effective method to protect the Goldstone radio spectrum while maintaining compatible operations for the military and Goldstone. M.G.

N81-13232*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AN ESTIMATING RULE FOR DEEP SPACE STATION CONTROL ROOM EQUIPMENT ENERGY COSTS **c83**
H. C. Younger *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 183-184 (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 09C

A rule is described which can be used to estimate power costs for new equipment under development, helping to reduce life-cycle costs and energy consumption by justifying design alternatives that are more costly, but more efficient. M.G.

N81-13233# Stanford Univ., Calif. Dept. of Mechanical Engineering.
THE ANALYSIS OF METAL-FORMING PROCESSES Final Report, 25 Apr. 1977 - 24 Apr. 1980
E. H. Lee and R. L. Mallett 11 Oct. 1980 9 p refs
(Grant DAAG29-77-G-0126)
(AD-A090841; ARO-14617.3-E) Avail: NTIS HC A02/MF A01 CSCL 20/11

A complete stress and deformation analysis of metal-forming process is necessary in order to assess the onset of metal-forming defects such as the initiation of cracks, the generation of high residual stresses or the occurrence of local flow abnormalities. Rigid-plastic theory can only predict stresses in the regions exhibiting significant current plastic flow so that to evaluate stresses throughout the material it is necessary to carry out an elastic-plastic analysis. A finite-element computer program to evaluate complete stress and deformation distributions has been developed and applied, bringing new insights to the assessment of metal forming processes. The plastic part of an elastic-plastic deformation is that remaining when the stress, and hence the elastic strain, is reduced to zero. Elastic deformation is that produced in this purely plastically deformed material by the action of stresses up to yield. The associated exact finite-deformation kinematics shows the almost universal assumption that the total rate of deformation is the sum of elastic and plastic rates to be in error. An incremental elastic-plastic theory is developed using the nonlinear kinematics. The theory is contrasted with that in common use and anomalies in the latter are discussed. GRA

N81-13234# National Bureau of Standards, Washington, D.C. National Engineering Lab.
GEOGRAPHICAL EXTRAPOLATION OF TYPICAL HOURLY WEATHER DATA FOR ENERGY CALCULATION IN BUILDINGS Final Report
Edward A. Arens, Larry E. Flynn, Daniel N. Nall, and Kalev Ruberg Aug. 1980 124 p refs Prepared in cooperation with Berkeley Solar Group, Calif.
(Contract EA-77-A-01-6010)
(PB80-213424; NBS-BSS-126; LC-80-600059) Avail: NTIS HC A06/MF A01 CSCL 10A

Two techniques are developed and tested for creating composite and synthetic hourly weather data for a wide range of sites. The first technique selects real weather data segments from a source multiyear weather record, and links them into a composite synthetic year, in which the hourly values are unchanged from the source. The second technique adjusts the real hourly data values of the source to create a more completely synthetic year. The resulting synthetic year or years can be used to provide data that is representative of long term climate for building energy prediction either at the first order station or at a nearby second order station. GRA

N81-13235# Connecticut Dept. of Transportation, Wethersfield. Bureau of Planning and Research.
PERFORMANCE OF A CONTINUOUSLY REINFORCED CONCRETE OVERLAY Final Report, Jul. 1975 - Feb. 1980
David G. Bowers Apr. 1980 35 p refs
(PB80-213069; FHWA/CT/RD-395-4-80/2; Rept-395-4-80-2)
Avail: NTIS HC A03/MF A01 CSCL 13B

The four and one half year performance of a 6 inch overlay placed on two different underlying materials is assessed. The design of the pavement incorporates nonaligned longitudinal joints between the old and new concrete. Transverse crack widths and spacings are determined for the various pavement lands. Longitudinal cracking is assessed and a description of all types of defects is given. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N81-13236 Illinois Univ. at Urbana-Champaign.
ERROR PERFORMANCE OF DIRECT SEQUENCE SPREAD

SPECTRUM SYSTEMS ON NONSELECTIVE GENERALIZED RAYLEIGH FADING CHANNELS Ph.D. Thesis
Robert Charles Hanlon 1980 111 p
Avail: Univ. Microfilms Order No. 8026511

The error performance of direct sequence spread spectrum multiple-access communications systems on nonselective fading channels is discussed. The channels considered are those for which the fading intensity is slow, nonselective, and exhibit a generalized Rayleigh distribution. The generalized Rayleigh distribution encompasses the important special cases of Rician (specular plus Rayleigh) fading, Nakagami m-distributed fading, and Rayleigh fading. Results are obtained for the special cases of a single cochannel interferer without additive noise and multiple independent cochannel interferers with additive white Gaussian noise. The results are developed as a series expansion in the moments of the cross correlation between the spreading codes (single interferer) or as a series expansion in the powers of the second moment of the code cross-correlation (multiple interferers). Dissert. Abstr.

N81-13237 Illinois Univ. at Urbana-Champaign.
SYNTHESIS OF OFFSET DUAL REFLECTOR ANTENNAS TRANSFORMING A GIVEN FEED ILLUMINATION PATTERN INTO A SPECIFIED APERTURE DISTRIBUTION Ph.D. Thesis
Fayez Mohamed Hyjazie 1980 84 p
Avail: Univ. Microfilms Order No. 8026529

The problem of transforming a given primary feed pattern into a desired aperture field distribution through two reflections by an offset dual reflector system is investigated using the concepts of geometrical optics. A numerically rigorous solution for the reflector surfaces is developed. The solution gives an exact aperture phase distribution and an aperture amplitude distribution accurate to with in some numerical tolerance. The solution for both of the reflector surfaces is derived in a one step process. However, this procedure does not always yield a smooth solution; i.e., the reflector surfaces may not be continuous or their slopes may vary too rapidly. In the event of nonexistence of a numerically rigorous smooth solution, an approximate solution that enforces the smoothness of the reflector surfaces can be obtained. In the approximate solution, the requirement for the aperture amplitude distribution is relaxed and the condition on the aperture phase distribution is continued to be exactly satisfied. Dissert. Abstr.

N81-13238 California Univ., Davis.
SMALL SIGNAL ANALYSIS OF MOS CAPACITOR BEHAVIOR IN THE DEPLETION AND WEAK INVERSION MODES Ph.D. Thesis
Akira Ito 1980 93 p
Avail: Univ. Microfilms Order No. 8027059

The small signal ac behavior of a metal oxide semiconductor capacitor is simulated by a numerical modeling technique. Although the model includes the effect of Shockley Read Hall generation-recombination centers it does not utilize the SRH lifetime concept since this concept is only valid for dc steady state conditions. The numerical simulation reveals that (1) the frequency response to incremental signals as dominated by the generation-recombination process, (2) there is a capacitance peak at a surface potential corresponding to the difference between the Fermi level and the trap level, (3) the capacitance peak shifts toward more positive or more negative potentials as the trap level shifts below or above the intrinsic level respectively, (4) a high concentration of trap centers at the semiconductor surface produces a correspondingly high value of capacitance. Dissert. Abstr.

N81-13239 Illinois Univ. at Urbana-Champaign.
EFFICIENT TECHNIQUES FOR NEAR-FIELD COMPUTATION AND SUBREFLECTOR ANALYSIS Ph.D. Thesis
Ali Muhammad Ali Rushdi 1980 149 p
Avail: Univ. Microfilms Order No. 8026583

A technique for near field computation is proposed. Integral representations of the radiating near field are obtained by making Fresnel approximations in the phase, magnitude, and direction of the exact field expression. Advantages of this method over other existing methods are shown, and details for implementing the method for both planar aperture and reflector antennas are given. The problem of reflection from smooth convex surfaces is considered. A generalization of the conventional geometrical optics is presented and closed form expressions are derived. The derivation of this generalized geometrical optics formula is based on the Fresnel transformation between two planes, one of which contains the specular point, while the other passes through the observation point. An efficient technique for computing the reflected field from a smooth numerically specified surface is developed. Both surface interpolation and search for the specular point are bypassed. The method starts by computing the reflected rays off the surface at the numerically specified points. The observation point is associated with the pencil composed of the reflected rays nearest to it. Dissert. Abstr.

N81-13240 Princeton Univ., N. J.
APPROXIMATE REPRESENTATION OF BANDLIMITED SIGNALS Ph.D. Thesis
Alexander Sonnenschein 1980 164 p
Avail: Univ. Microfilms Order No. 8027717

The finite bandwidth of a communications channel imposes certain constraints upon the class of signals which may be transmitted over the channel as an acceptable level of distortion. Once these constraints are specified, there naturally, arise questions concerning the efficient representation of such signals, the maximum rate of their transmission and the possibility of signal receiver given either the time limited version of the signal or a truncated representational series. The primary focus is the approximate representation of bandlimited signals. The theoretical possibilities of approximating a bandlimited signal in order to transmit data at less than the Nyquist rate are explored. Several known results are modified and combined to form a general procedure that uses the inadequate transmission rate by taking samples of an appropriate signal approximation. Coefficients of the expansion are derived from those of the prolate function expansion and consequently, only knowledge of the signal over a finite time interval is needed. Dissert. Abstr.

N81-13241 Arizona Univ., Phoenix.
THE INITIAL-VALUE PROBLEM FOR ZERO AREA PULSES Ph.D. Thesis
Sami Ali Shakir 1980 92 p
Avail: Univ. Microfilms Order No. 8027746

The initial value problem for coherent pulse propagation for zero area pulses was studied. The mathematical technique of the inverse scattering method (ISM) was employed to deduce general rules by which one can predict the kind of output pulses for a given input pulse impinging on a resonant attenuator. This study is relevant since the area theorem cannot provide unambiguous information about zero area pulses. Thus, in effect, an equivalent and more general formulation is introduced to the theorem in terms of the reflection coefficient of the ISM. The poles of the coefficient correspond to the steady state solitary pulses called solitons. It is demonstrated that the conversion equations are of limited use when applied to zero area pulses. They give satisfactory results only in a limited region. The predictions of the conservation equations are compared to the predictions of the ISM and it is concluded that zero area pulses, the ISM is the only known satisfactory approach. Dissert. Abstr.

N81-13242# Rome Air Development Center, Griffiss AFB, N.Y.
STUDY OF THE POTENTIAL OF MAIN-BEAM NULLING WITH AN OVERLAPPED SUBARRAY ANTENNA
Roland L. Fante Mar. 1980 26 p refs
(AF Proj. 2305)
(AD-A091112; RADC-TR-80-117) Avail: NTIS HC A03/MF A01 CSCL 09/5

A study has been made of the possibility of placing nulls in the main beam of an overlapped subarray antenna by controlling the subarray pattern. We have found that it is possible to form main-beam nulls by this technique, but that the nulls are relatively narrow band. GRA

N81-13243# Armed Forces Communications and Electronics Association, Eatontown, N. J.
PROCEEDINGS OF THE 5TH ANNUAL SEMINAR: THE

ART OF COMMUNICATIONS INTERFACES. C3I ENVIRONMENT FOR THE 1990'S
Bernard D. DeMarinis 21 Oct. 1980 195 p refs Seminar held at Eatontown, N.J., 21-22 Oct. 1980
(AD-A091042; AFCEA-FM-A-5) Avail: NTIS HC A09/MF A01 CSCL 17/2

Several papers by leading authorities address 'The C3I Environment of the 90s'. Furthermore, the collective efforts of the Army and Industry in countering the battlefield information explosion is addressed. The need for ultra reliable and survivable networks with high mobility and the ability to operate in an intense/adverse electronic warfare environment is also highlighted. GRA

N81-13244# Naval Surface Weapons Center, White Oak, Md. Dept. of Research and Technology.
CALCULATION OF ELECTROMAGNETIC SCATTERING BY A PERFECT CONDUCTOR Interim Report, FY 1980
A. K. Aziz, M. R. Dorr, and R. B. Kellogg 5 Jun. 1980 29 p refs
(AD-A091027; NSWC/TR-80-245) Avail: NTIS HC A03/MF A01 CSCL 20/3

An electromagnetic wave of given shape and frequency falls on a perfectly conducting body or collection of bodies. It is desired to calculate the resulting field. A new method is presented for the numerical solution of this problem, a computer program implementing the method is described, and the results of some numerical calculations are given. GRA

N81-13245# King Research, Inc., Vienna, Va.
DEVELOPMENT AND APPLICATION OF THE MAXIMUM ENTROPY METHOD AND OTHER SPECTRAL ESTIMATION TECHNIQUES Summary Report
William R. King Sep. 1980 133 p refs
(Contract N00014-80-C-0519)
(AD-A090291) Avail: NTIS HC A07/MF A01 CSCL 12/1

This summary report is a collection of four separate progress reports prepared under three contracts, which are all sponsored by the Office of Naval Research in Arlington, Virginia. This report contains the results of investigations into the application of the maximum entropy method (MEM), a high resolution, frequency and wavenumber estimation technique. The report also contains a description of two, new, stable, high resolution spectral estimation techniques that is provided in the final report section. Many examples of wavenumber spectral patterns for all investigated techniques are included throughout the report. The maximum entropy method is also known as the maximum entropy spectral analysis (MESA) technique, and both names are used in the report. Many MEM wavenumber spectral patterns are demonstrated using both simulated and measured radar signal and noise data. Methods for obtaining stable MEM wavenumber spectra are discussed, broadband signal detection using the MEM prediction error transform (PET) is discussed, and Doppler radar narrowband signal detection is demonstrated using the MEM technique. It is also shown that MEM cannot be applied to randomly sampled data. The two new, stable, high resolution, spectral estimation techniques discussed in the final report section, are named the Wiener-King and the Fourier spectral estimation techniques. The two new techniques have a similar derivation based upon the Wiener prediction filter, but the two techniques are otherwise quite different. Further development of the techniques and measurement of the technique spectral characteristics is recommended for subsequent investigation. GRA

N81-13246# GTE Sylvania, Inc., Needham Heights, Mass.
AUTOMATED PERFORMANCE MONITORING AND ASSESSMENT FOR DCS DIGITAL SYSTEMS Final Technical Report, Feb. 1978 - Jan. 1980
Louis E. Jankauskas, Michael Mizesko, Warren J. Falzone, Brian D. Chace, and George G. Wilson Griffiss AFB, N. Y. RADC Jul. 1980 142 p refs
(Contract F30602-76-C-0433; AF Proj. 2155)
(AD-A090318; RADC-TR-80-196) Avail: NTIS HC A07/MF A01 CSCL 17/2

As an aid in evaluating technical control techniques, an emulation facility that automatically performs the status monitoring, performance assessment, and fault isolation transmission control functions as they apply to the digital Defense Communications System (DCS) has been developed. This emulation facility is a multicomputer system which automatically monitors and isolates faults for digital transmission equipments. The status monitoring and performance assessment functions are performed by two processors, the Adaptive Channel Estimator (ACE) and an LSI 11/03, the composite being referred to as the CPMAS-D unit. When the software residing in the CPMAS-D unit detects a monitor point transition, it transmits the monitor point information to the CPMAS Emulator, a PDP 11/60 minicomputer. These messages, called exception reports, enable the CPMAS Emulator to perform its prime mission: fault isolation. A unique fault isolation algorithm has been developed for test with this emulation facility. The algorithm consists of three discrete steps. First, the equipment alarms are mapped into their effect upon each transmission path (link, supergroup, group, or channel). Second, the stations with the faulty equipment are located by deleting the impact of sympathetic alarms. Third, the faulty equipment is identified using the equipment alarm status. Testing of the fault isolation algorithm is enhanced by an emulated network consisting of up to 16 stations, 2048 equipments, and two nodal control areas. Monitor point simulators and T1-4000 multiplexers, which provide simulated and real time inputs to two CPMAS-D units, are also part of the emulation facility. Technical control terminals are provided to evaluate man/machine operation in an automated technical control environment. GRA

N81-13247# General Atronics Corp., Philadelphia, Pa.
HARMONIC CANCELLATION SYSTEM Final Technical Report, Sep. 1978 - Jan. 1980
Stephen J. Rosasco Griffiss AFB, N.Y. RADC Sep. 1980 82 p refs
(Contract F30602-78-C-0191; AF Proj. 2338)
(AD-A091168; RADC-TR-80-116; GAC-3398-3385-24) Avail: NTIS HC A05/MF A01 CSCL 17/2

The objective of this effort was to investigate Interference Cancellation System (ICS) techniques to solve the harmonic and intermoduation products (IMP) generated as the result of high power jammers, HF/VHF/UHF transmitter signals impinging on a nonlinear junction somewhere on the aircraft during flight. The problem becomes very complex when trying to receive a desired satellite-starved signal. Since a reference sample of the nonlinear signal is not available, it has to be synthesized to a high degree of accuracy in order to be able to cancel the interfering signal. The crux of this problem is the synthesization of the nonlinear signal without concurrently cancelling the desired signal. GRA

N81-13248# ITT Gilfillan, Inc., Van Nuys, Calif.
SIGNAL PROCESSOR FOR UNATTENDED RADAR (SPUR), PHASE 2 Final Technical Report, May - Sep. 1979
John M. Milan, Charles D. Lucas, Jr., and Daniel M. Kikuta Aug. 1980 139 p
(Contract F30602-78-C-0288; AF Proj. 4506)
(AD-A091189; RADC-TR-80-254) Avail: NTIS HC A07/MF A01 CSCL 17/9

This final report documents the results of a five month Validation Program conducted during Phase 2 of a contract to examine Signal Processing for Unattended Radars. The Validation Program was based on risk reduction recommendations generated during Phase I of the SPUR: Conceptual Design. Identified critical circuits and firmware were designed, some developed, and some tested to validate the estimates of reliability, power, functional performance, fault monitoring and recovery, and stability of the recommended processor. Recommendations for further development and testing are included. GRA

N81-13249# American Electronic Labs., Inc., Lansdale, Pa.
WALSH PREPROCESSOR Final Technical Report, 20 Feb. 1979 - 31 Mar. 1980
James VanCleave Aug. 1980 71 p
(Contract F30602-79-C-0048; AF Proj. 2220)
(AD-A091188; RADC-TR-80-253; AEL-10492-4200) Avail: NTIS HC A04/MF A01 CSCL 17/2

This report describes a technique and equipment for detecting pulsed signals in a high noise environment. The performance of this technique approaches matched filter techniques for signals where the pulse parameters are not known a priori. A common problem in the area of signal processing is that of the detection

of pulse signals having very low signal to noise ratios (SNR). This problem is worsened when major signal parameters (pulse width and time of arrival) are not known. The purpose of this program was to develop an improved exploratory development model of a system to detect the presence of low SNR signals, on a single pulse-by-pulse basis. The technique chosen for this program was the use of the Walsh Transform as the basis for a two transform digital filter. This technique has been demonstrated by AEL as a result of in-house IR/D programs and implemented to USAF preliminary requirements under a previous contract for a Walsh Adaptive Filter (RADC Report TR-78-82 for Contract F30602-76-C-0299). The current program was to further develop the technique and to fabricate a programmable unit suitable for test and evaluation purposes against a variety of potential applications. The system name, Walsh Preprocessor (WP), was derived from the use of a Walsh transform to adaptively filter signals of varying pulse widths and repetition rates. GRA

N81-13250# Applied Science Associates, Inc., Apex, N. C.
A STUDY OF TERRAIN SCATTERING PHYSICS Interim Report
Gary S. Brown Aug. 1980 76 p refs
(Contract F19628-78-C-0211; AF Proj. 2305)
(AD-A091320; RADC-TR-80-284) Avail: NTIS
HC A05/MF A01 CSCL 20/3

This report presents interim results of a study to improve existing models for scattering from rough terrain. The two-scale composite surface model is first corrected to properly account for shadowing. This correction shows that both the optical and Bragg scattering terms in the expression for sigma degrees go to zero as grazing incidence is approached. The shadowing function for non-Gaussian surfaces is shown to be easily obtained from existing theories and numerical results for exponentially distributed surfaces are presented. The two-scale composite surface based upon the Burrows perturbation theory is extended to the following cases; bistatic scattering from a dielectric surface with small scale roughness, and bistatic scattering from a dielectric surface with large and small scales of roughness. Comparisons are made with the Rice theory for both cases. Finally, it is shown how an existing theoretical relationship between the height and slope probability density functions can be used in practically obtaining one from the other. GRA

N81-13251# Range Commanders Council, White Sands Missile Range, N. Mex. Inter-Range Instrumentation Group.
NONCOHERENT C-BAND TRANSPONDER STANDARDS
1980 18 p
(AD-A091282; IRIG-STANDARD-115-80) Avail: NTIS
HC A02/MF A01 CSCL 17/9

Most of the modern noncoherent C-band pulse transponders available today are the result of commercial development with some guidance from the U.S. Government in terms of specifications or user requirements. The transponder manufacturing field is rather small and limited to companies who have become strongly entrenched over the years. As a general statement, most of these companies meet, or can meet, the standards set forth in this document. These standards have been written to accommodate the present state of the art in both the radar and the transponder fields. Not all existing C-band instrumentation radars are completely compatible with all existing transponders. These system standards are an IRIG recommendation primarily for the purpose of establishing and preserving compatibility of the noncoherent C-band pulse transponders and C-band range instrumentation radars of the present and near future. GRA

N81-13252# Mitre Corp., Bedford, Mass.
A DATA LINK DESIGN WITH A VARIABLE DATA RATE AND VARIABLE JAM RESISTANT CAPABILITY Progress Report, Sep. 1978 - Sep. 1979
B. D. Campbell, E. A. Palo, and M. A. Poole Jul. 1980 97 p refs
(Contract F19628-79-C-0001; AF Proj. 7130; AF Proj. 8100)
(AD-A091319; MTR-3850; RADC-TR-80-214) Avail: NTIS
HC A05/MF A01 CSCL 17/4

This report describes work performed on project 7130 during FY79. The objective of this phase was to address the technical issues involved in variable data rate/variable jam resistant data link technology. The design approach was based on cost-performance trade-offs for the signal processing elements of a two terminal, data link system with up to 1 GHz spread spectrum bandwidth operating with data at rates of from 100 bps to 1 Mbps. The design and design process for a laboratory model are presented. Cost estimates for large production quantities for the data link are also presented. GRA

N81-13253*# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ITERATIVE TECHNIQUES FOR MINIMUM PHASE SIGNAL RECONSTRUCTION FROM PHASE OR MAGNITUDE
Thomas F. Quatieri and Alan V. Oppenheim 1 Aug. 1980 38 p refs
(Grant NAG5-2; Contracts F19628-80-C-0002;
N00014-75-C-0951; AF Proj. 4594; NR Proj. 049-328)
(NASA-CR-163821; AD-A091111; TN-1980-34;
ESD-TR-80-91) Avail: NTIS HC A03/MF A01 CSCL 09/5

In this report, we develop iterative algorithms for reconstructing a minimum phase sequence from the phase or magnitude of its Fourier transform. The iterative techniques result in two potentially important computational algorithms. The first is a means of implementing the Hilbert transform of the log-magnitude or phase of the Fourier transform of a minimum phase sequence. This procedure avoids problems of phase unwrapping and aliasing inherent in the direct discrete Fourier transform implementation of the Hilbert transform. The second algorithm is a new method of computing samples of the unwrapped phase. As compared with other available phase unwrapping algorithms, this approach does not rely on adding 2 pi multiples to samples of the principal value of the phase. GRA

N81-13254# California Univ., San Diego, La Jolla. Dept. of Applied Mechanics and Engineering Sciences.
INPUT SIGNAL SYNTHESIS FOR LINEAR AND NONLINEAR SYSTEM IDENTIFICATION Final Scientific Report, 1 Jun. 1975 - 31 May 1980
H. W. Sorenson 1980 36 p refs
(Grant AF-AFOSR-2839-75; AF Proj. 2304)
(AD-A091039; AFOSR-80-0991TR) Avail: NTIS
HC A03/MF A01 CSCL 09/5

This study will consider the general problem of optimal input signal synthesis for dynamic systems. Different optimality criteria are to be investigated and compared. The primary emphasis in the study shall be on the development of feedback control policies for specific criteria. The improvements possible through the use of suitably chosen input signals will be investigated. GRA

N81-13255# Rome Air Development Center, Griffiss AFB, N.Y. Electromagnetic Sciences Div.
A MODEL FOR HIGH FREQUENCY RADAR AURORAL CLUTTER
Terence J. Elkins Mar. 1980 109 p refs
(AF Proj. 2305)
(AD-A091049; RADC-TR-80-122) Avail: NTIS
HC A06/MF A01 CSCL 17/9

A model is developed to permit estimation of the effects of irregularities in the auroral ionosphere in producing clutter experienced by Over-The Horizon radars operating at high geomagnetic latitudes. The model is used on various sources of data, including auroral radar (HF, VHF, UHF), vertical incidence ionosondes, satellite particle detectors, and optical sensors (ground-based and satellite-borne). The model addresses both the amplitude and Doppler components of auroral radar clutter and also the effect of ionospheric refraction that is extremely important at high frequencies. Consideration is given to the question of predictability of the effects of auroral clutter on HF radar systems. An important component of the model is the incorporation of data from the Polar Fox II experiment conducted for the purpose of evaluating auroral clutter effects on OTH radars. GRA

N81-13256# Sandia Labs., Albuquerque, N. Mex. Signal Analysis Div.
GENERALIZED FREE-SPACE EQUATION FOR COMPUTATION OF POWER TRANSFERRED BETWEEN TWO ANTENNAS
Robert M. Axline, Jr. Sep. 1980 33 p refs
(SAND-80-1733) Avail: NTIS HC A03/MF A01

A free-space, radio frequency communications link over which

antennas A sub t transmits and antenna A sub r receives is defined. The two antennas are stationary, but they may be oriented with respect to one another in any way. For this link, a generalized free-space equation is derived that one can use to exactly compute power transferred between A sub t and A sub r. The form of the generalized equation is very similar to that of the normal free-space equation; however, to account for polarization characteristics of the antennas, the product gain term (G sub t G sub r) is written as the squared magnitude of the dot-product of two complex vectors, one for A sub t and one for A sub r. Each vector is a function of three measured antenna patterns; each vector completely described both radiating and receiving properties of the antenna to which it applies. M.G.

N81-13257# Sandia Labs., Albuquerque, N. Mex. Applied Biology and Isotope Utilization Div.

PRECISION ADMITTANCE MEASUREMENTS OF COAXIALLY-DRIVEN MONOPOLE ANTENNAS: AN EXPERIMENTAL STUDY OF JUNCTION EFFECTS

Marvin E. Morris May 1980 49 p refs

(Contract DE-AC04-76DP-00789)

(SAND-79-2047) Avail: NTIS HC A03/MF A01

Precision admittance measurements are presented for coaxially-driven tubular monopole antennas for a range of drive frequencies, antenna lengths, and drive geometry configurations. These precision admittance measurements were used to calculate junction effects and these junction effects are compared with the results of theoretical calculations. The admittances are also directly compared with computational results for the coaxially-driven monopole antenna. DOE

N81-13258# Princeton Univ., N. J. Plasma Physics Lab.

PLASMA DENSITY MEASUREMENTS USING MEASUREMENTS USING FM-CW MILLIMETER WAVE RADAR TECHNIQUES

J. L. Doane, E. Mazzucato, and G. L. Schmidt Sep. 1980 20 p refs

(Contract DE-AM02-76CH-03073)

(PPPL-1690) Avail: NTIS HC A02/MF A01

Modified radar techniques using swept millimeter wave oscillators are useful for determining when a particular density has been reached in a plasma. Narrowband measurements demonstrate the suitability of these techniques for controlling high power auxiliary plasma heating systems. Broadband measurements using these same techniques are proposed, by which the density profile could be determined. DOE

N81-13259# Institute for Telecommunication Sciences, Boulder, Colo.

COMPARISONS OF ANALYTICAL AND NUMERICAL CALCULATIONS OF COMMUNICATIONS PROBABILITY

Leslie A. Berry Jun. 1980 68 p refs

(PB80-211394; NTIA/Rept-80-41) Avail: NTIS HC A04/MF A01 CSCL 09D

An analytical formula for the probability of communications in a land mobile environment and computer program for probabilistic calculations of interference produce identical answers for identical inputs. The assumptions, input, and output of the two models are compared. The assumption that interfering sources transmit randomly and independently is of interest for mobile radio services. The effects of the greater variety of input assumptions possible with the computer method are illustrated numerically. To illustrate possible applications, the number of statistically identical links that can operate with specified reliability in a given area is computed with the numerical model. GRA

N81-13260# Middleton (David), New York.

A TUTORIAL REVIEW OF THE NEW EMI (ELECTROMAGNETIC INTERFERENCE) MODELS AND THEIR EFFECTS ON RECEIVER PERFORMANCE

David Middleton May 1980 73 p refs

(PB80-211188; NTIA-CR-80-7) Avail: NTIS HC A04/MF A01 CSCL 17B

Models of electromagnetic interference (EMI) developed over the last five years (1974 to 1979), for the first time provide canonical, analytically tractable, and experimentally well established quantitative descriptions of nearly all EMI environments. These models are: (1) physically derived; (2) canonical in the sense that they are invariant of the nature and waveform of the source and details of preparation, as far as their formal analytical structure is concerned; (3) are highly nonGaussian; and (4) are analytically and computationally manageable. Their principal quantitative and most widely applied form is embodied in the first order probability distributions of the (instantaneous) amplitude and envelope of the received waveform following the linear front end states of a typical receiver. Three basic EMI models are distinguished: class A, B, and C, respectively involving sets of three, six, and eight, physically derived parameters which are measurable from observed EMI amplitude (or envelope) data. These three basic classes are defined in terms of receiver bandwidth vis-a-vis that of the EMI. GRA

N81-13261# Institute for Telecommunication Sciences, Boulder, Colo.

MEASUREMENTS OF THE EFFECT OF VEHICLE IGNITION NOISE ON LAND-MOBILE VOICE CHANNEL

W. J. Hartman Jun. 1980 25 p refs Sponsored in part by Motor Vehicle Manufacturers Association of the United States, Inc., Detroit

(PB80-211451; NTIA/Rept-80-43) Avail: NTIS HC A02/MF A01 CSCL 17B

Measurements of the noise intelligibility over landmobile systems in the presence of vehicle noise are presented. These are compared with several statistical noise parameters obtained from measured amplitude probability distributions. DOE

N81-13262# Institute for Telecommunication Sciences, Boulder, Colo.

FADING STATISTICS ON A 23 KM LINK AT 9.6 AND 28.8 GHz

R. H. Ott, K. C. Allen (Boulder Experimental Studies Inst., Colo.), E. J. Violette, R. H. Espeland, M. C. Thompson, Jr., and A. R. Mitz Jun. 1980 53 p refs

(PB80-211410; NTIA/Rept-80-40) Avail: NTIS HC A04/MF A01 CSCL 20N

An experimental study of atmospheric multipath on a 23 km link at 9.6 and 28.8 GHz near Boulder, Colorado, is described. The preliminary observations were made for three days in July 1979 when a strong inversion layer was present, creating an elevated tropospheric duct. The possible influence of antenna aperture size on atmospheric multipath was investigated by observing fades and enhancements on the 28.8 GHz center using a 10 degrees horn and a 1.2 degree parabolic dish. Continuous height gain observations, were obtained using the 300 m, tower at Erie, Colorado, as one end of the link. Meteorological data at the tower were also recorded during observation periods of the radio signal. GRA

N81-13263# Institute for Telecommunication Sciences, Boulder, Colo.

COMPARISON OF AVAILABLE METHODS FOR PREDICTING MEDIUM FREQUENCY SKY-WAVE FIELD STRENGTHS

Margo PoKempner Jun. 1980 98 p refs

(PB80-211444; NTIA/Rept-80-42) Avail: NTIS HC A05/MF A01 CSCL 17B

The chronological development of the available methods for predicting medium frequency skywave field strengths is presented with a brief discussion of each method. Measured field strengths for 36 medium frequency sky wave paths are compared with the predicted field strengths from several different prediction methods. Based on the rms errors between observations and predictions, the 1938 Cairo Curves provide the best estimates of sky wave field strengths for very long paths worldwide. A new prediction method developed for use in North and South America only, provides improved estimates of the sky wave field strengths for paths less than 3500 km. GRA

N81-13216*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

CAPACITY, CUTOFF RATE, AND CODING FOR A DIRECT-DETECTION OPTICAL CHANNEL

J. L. Massey (Swiss Federal Technical Univ., Zurich) *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 68-76 refs (For primary document see N81-13210 04-31)

Avail: NTIS HC A09/MF A01 CSCL 17B

N81-13217*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A PROTOTYPE DSN X/S-BAND FEED: DSS 13 APPLICATION STATUS
W. Williams and H. Reilly *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 P 77-88 refs (For primary document see N81-13210 04-31)
(Rept-4) Avail: NTIS HC A09/MF A01 CSCL 20N

N81-13218*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A 20-kW X-BAND UPLINK TRANSMITTER DEVELOPMENT
R. B. Kolbly *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 89-95 ref (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 17B

N81-13220*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
INTERLEAVED BLOCK CODES FOR THE PHOTON CHANNEL
R. J. McEliece *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 98-102 refs (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 17B

N81-13221*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RFI CHANNELS
R. J. McEliece *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 103-106 refs (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 17B

N81-13226*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RFI PREVENTION FOR COLOCATED ANTENNAS
T. K. Peng *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 135-144 refs (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 20N

N81-13227*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PROTOTYPE REAL-TIME BASEBAND SIGNAL COMBINER
L. D. Howard *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 145-151 refs (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 17B

N81-13229*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
BLOCK 4 RECEIVER TRACKING LOOP PERFORMANCE IN THE PRESENCE OF A CW RFI
M. K. Sue *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 155-167 refs (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 20N

N81-13230*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RADIO FREQUENCY PERFORMANCE OF DSS 14 64-METER ANTENNA AT X-BAND USING AN IMPROVED SUBREFLECTOR
A. J. Freiley *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 168-176 refs (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 20N

N81-13231*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GOLDSTONE RADIO SPECTRUM PROTECTION
B. A. Gaudian and R. B. Cushman (Bendix Field Engineering Corp.) *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 177-182 (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 17B

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N81-13264 Illinois Univ. at Urbana-Champaign.
RESIDUE NUMBER SYSTEM RECURSIVE DIGITAL FILTERING WITH ERROR CORRECTION CAPABILITIES Ph.D. Thesis
Mark Howard Etzel 1980 149 p
Avail: Univ. Microfilms Order No. 8026489

Specialized residue classes in which scaling is a simple operation that can be easily mechanized are developed. The resulting hierarchy of useful two, three, and four modulus classes are described with an analysis of the quantization error due to scaling. Computer simulations illustrate the filter performance in these RNS classes. Inherent properties of RNS digital filters that can be used for such purposes are presented. Theory is given for handling overflow suppression and single error detection and correction both separately and simultaneously, and conditions for distinguishing single and double errors are discussed. The concept of gradual system degradation is described including results of computer simulations of filters with error handling capabilities and which are capable of continued operation in the presence of recurring errors. Possible hardware implementation of such a system are explored. Dissert. Abstr.

N81-13265 Pittsburgh Univ., Pa.
TWO DIMENSIONAL DIGITAL FILTERING IN A FINITE FIELD Ph.D. Thesis
Krishnanand Anant Prabhu 1980 148 p
Avail: Univ. Microfilms Order No. 8028017

The problem of one dimensional and two dimensional digital filtering in a finite field is studied, with emphasis on the two dimensional case. The problem is formulated in terms of a study of polynomials and rational functions with coefficients belonging to a finite field. For purposes of illustration only binary digital filters are considered but the results obtained extend quite easily to any finite field, GF(q). The main thrust is directed towards a study of the structure and properties of the impulse response of such filters. Dissert. Abstr.

N81-13266 Purdue Univ., Lafayette, Ind.
BEHAVIOR OF PROGRAMMABLE INTERFACE TRANSDUCERS IN A ZINC OXIDE ON SILICON SYSTEM Ph.D. Thesis
Ching-Ling Liu 1980 145 p
Avail: Univ. Microfilms Order No. 8027301

The behavior of a type of surface acoustic wave layered configuration with an interdigital transducer placed between the ZnO layer and the oxidized silicon substrate was investigated. The interface transducer configuration, by effectively controlling the influence of substrate conductivity on the performance of the interdigital transducer, is shown to be readily programmable. The electromechanical coupling coefficient and input impedance of the configuration are evaluated by methods which include the effect of the finite conductance of the silicon substrate. Theoretical results are reported which demonstrate the dependence of interdigital transducer characteristics on layer thickness and bias. Measurements of insertion loss reveal a large dependence on bias that is in agreement with the predictions of theory. It is concluded that with a suitable choice of semiconductor resistivity and layer thickness the design of a new class of programmable device is feasible. Dissert. Abstr.

N81-13267 Northwestern Univ., Evanston, Ill.
CHARGE TRANSPORT PHENOMENA IN SODIUM BETA ALUMINA SOLID ELECTROLYTE Ph.D. Thesis
James Seng-Ju Ni 1980 157 p
Avail: Univ. Microfilms Order No. 8026886

With the aid of beta network analyzer conductivity measurements were made on highly-dense sodium beta alumina samples prepared with nominal composition 8.85 wt% Na2O.075 wt%

Li2O, and 90.4 wt% Al2O3; these observations covered a wide frequency range (10 Hz to 700 kHz) and a temperature range extending from 25 to 300 C. The bulk conductivity exhibited a non-Arrhenius type behavior when plotted as log omicron sub b T vs. T(-1) plot, the apparent activation energies changing from 0.150 eV at high temperatures to 0.217 eV at low temperatures. Ordering of the cation vacancies and Na+ ions on the conduction planes was considered to be responsible for the increase activation energy apparent at the lower temperatures. The activation energy for grain boundary conduction was found to range from 0.323 to 0.372 eV. The grain boundary capacitance, calculated from the complex-admittance analysis, appears to obey a space-charge model. A systematic study of the effects of CaO-doping on the bulk, on the grain boundary conductivities, and on the grain boundary capacitance of sodium beta alumina was likewise carried out using a complex-admittance method. Dissert. Abstr.

N81-13268 Purdue Univ., Lafayette, Ind.
CONDUCTION MECHANISMS IN THICK FILM RESISTORS Ph.D. Thesis
James Max Himelick 1980 204 p
Avail: Univ. Microfilms Order No. 8027287

The influence of substrate dissolution during the high temperature firing on the electrical properties of ruthenium dioxide-lead borosilicate thick film resistors is discussed. A resistor 25 micron thick that is fired for 10 minutes at 840 C will dissolve 4 microns of the substrate surface. The presence of the alumina in the glass phase retards the growth of the resistor microstructure or chains of conducting particles by increasing the glass viscosity and slightly decreasing the solubility of RuO2. These physical changes brought about measurable changes in the electrical properties. Four terminals resistors were fired onto 614 AlSiMag substrates under various conditions of time and temperature. The sheet resistance, hot (+125 C) and cold (-55 C) temperature coefficients of resistance, normalized resistance versus temperature (-55 to +125 C), and noise index were measured. As predicted, resistors with increasing amounts of substrate in the glass phase demonstrated slower development of electrical properties. A second group of experiments was performed to determine conduction mechanisms in thin films of the standard and 10 w/0 substrate glasses. Additional results are discussed. Dissert. Abstr.

N81-13269*# Pittsburgh Univ., Pa. Dept. of Electrical Engineering.
DETERMINATION OF EFFICIENCIES, LOSS MECHANISMS, AND PERFORMANCE DEGRADATION FACTORS IN CHOPPER CONTROLLED dc VEHICLE MOTORS. SECTION 1: TEST PROGRAM RESULTS AND RECOMMENDATIONS Final Report
Howard B. Hamilton and Elias Strangas 30 Dec. 1980 120 p refs
(Grant NsG-3163)
(NASA-CR-163817) Avail: NTIS HC A06/MF A01 CSCL 09C

The conventional series motor model is discussed as well as procedures for obtaining, by test, the parameters necessary for calculating performance and losses. The calculated results for operation from ripple free dc are compared with observed test results, indicating approximately 5% or less error. Experimental data indicating the influence of brush shift and chopper frequency are also presented. Both factors have a significant effect on the speed and torque relationships. The losses and loss mechanisms present in a dc series motor are examined and an attempt is made to evaluate the added losses due to harmonic currents and fluxes. Findings with respect to these losses is summarized. A.R.H.

N81-13270*# Pittsburgh Univ., Pa. Dept. of Electrical Engineering.
DETERMINATION OF EFFICIENCIES, LOSS MECHANISMS, AND PERFORMANCE DEGRADATION FACTORS IN CHOPPER CONTROLLED dc VEHICLE MOTORS. SECTION 2: THE TIME DEPENDENT FINITE ELEMENT MODELING OF THE ELECTROMAGNETIC FIELD IN ELECTRICAL MACHINES: METHODS AND APPLICATIONS Ph.D. Thesis
Howard B. Hamilton and Elias Strangas 30 Dec. 1980 148 p refs
(Contract NsG-3163)
(NASA-CR-163818) Avail: NTIS HC A07/MF A01 CSCL 09C

The time dependent solution of the magnetic field is introduced as a method for accounting for the variation, in time, of the machine parameters in predicting and analyzing the performance of the electrical machines. The method of time dependent finite element was used in combination with an also time dependent construction of a grid for the air gap region. The Maxwell stress tensor was used to calculate the airgap torque from the magnetic vector potential distribution. Incremental inductances were defined and calculated as functions of time, depending on eddy currents and saturation. The currents in all the machine circuits were calculated in the time domain based on these inductances, which were continuously updated. The method was applied to a chopper controlled dc series motor used for electric vehicle drive, and to a salient pole sychronous motor with damper bars. Simulation results were compared to experimentally obtained ones. A.R.H.

N81-13271# Office of the Project Manager Standoff Target Acquisition System, Fort Monmouth, N.J.
NOISE PERFORMANCE OF A NEW TYPE OF LOW NOISE FM DETECTOR
Allan B. Tarbell Jun. 1980 15 p refs
(AD-A090444) Avail: NTIS HC A02/MF A01 CSCL 09/4

The development of the wideband quasi-coherent detector described in this paper resulted from the need for a low noise, very low delay FM detector for use in power line protection systems. At NTC-1975, Klapper and Kratt described the new detector and presented the results of their analyses of output distortion and performance in the presence of sine wave interference. Recently they have published a more detailed analysis. These previous authors showed that under usual operating conditions the detector output contains distortion components that are relatively small. They also found that in the presence of weak sine wave interference their detector performed approximately the same as the limiter discriminator. However, with a strong interfering carrier the Klapper-Kratt detector performed much better than did the limiter discriminator. The detector's performance in the presence of strong interference led to the inquiry whether the new detector might possibly provide threshold extension. The detector (without limiter) has now been analyzed with noise and found to perform identically to the limiter discriminator above threshold. However, threshold occurs at a higher CNR than that of the conventional limiter discriminator. The results of this analysis were confirmed experimentally, by assembling and testing a version of the new detector family. It was also verified experimentally that the Klapper-Kratt detector preceded by a limiter performs identically to the limiter discriminator. GRA

N81-13272# Army Electronics Research and Development Command, Fort Monmouth, N.J. Electronics Technology/Devices Lab.
THE ELECTRON BEAM SEMICONDUCTOR (EBS) AMPLIFIER
Robert M. True and James F. Baxendale Jul. 1980 42 p refs
(DA Proj. 1L1-62705-AH-94)
(AD-A091283: DELET-TR-80-13) Avail: NTIS HC A03/MF A01 CSCL 09/1

The Electron Beam Semiconductor (EBS) concept has existed for three decades; but only within the last decade has an active, well-defined program been underway to develop devices that can operate as high-power radio frequency (RF) amplifiers, fast risetime switches, and current and voltage pulse amplifiers. This report discusses the test procedures, data and results of reliability testing of RF and video pulse EBS amplifiers at Electronics Research and Development Command (ERADCOM), Fort Monmouth, New Jersey. Also, the experimental analysis of the series connected diode EBS device is described in detail. Finally, the report concludes with a discussion of the state-of-the-art of EBS and future trends of the technology. GRA

N81-13273# Martin Marietta Corp., Denver, Colo. Failure Analysis Lab.

SEM ANALYSIS TECHNIQUES FOR LSI MICROCIRCUITS, VOLUME 1 Final Technical Report, 8 Sep. 1978 - 8 Feb. 1980

J. R. Beall, W. E. Echols, and D. D. Wilson Griffiss AFB, N.Y. RADC Aug. 1980 323 p refs

(Contract F30602-78-C-0354; AF Proj. 2338)

(AD-A090922; MCR-80-508-Vol-1; RADC-TR-80-250-Vol-1) Avail: NTIS HC A14/MF A01 CSCL 09/5

Scanning Electron Microscope (SEM) Applications were developed and demonstrated for determining circuit configuration and organization. These applications employ voltage contrast and Electron Beam Induced Current (EBIC) techniques. Procedures were developed utilizing these applications to evaluate semiconductor memory circuits. These procedures provide practical methods for developing die maps, electrical circuit schematics, logic diagrams, device block diagrams and memory array bit maps. The SEM data are used in conjunction with light microscopy data to provide significant improvements in device characterization. GRA

N81-13274# Martin Marietta Corp., Denver, Colo. Failure Analysis Lab.

SEM ANALYSIS TECHNIQUES FOR LSI MICROCIRCUITS, VOLUME 2 Final Technical Report, 8 Sep. 1978 - 8 Feb. 1980

J. R. Beall Griffiss AFB, N.Y. RADC Aug. 1980 208 p refs

(Contract F30602-78-C-0354; AF Proj. 2338)

(AD-A090923; MCR-80-508-Vol-2) Avail: NTIS HC A10/MF A01 CSCL 09/5

Scanning Electron Microscope (SEM) Applications were developed and demonstrated for determining circuit configuration and organization. These applications employ voltage contrast and Electron Bean Induced Current (EBIC) techniques. Procedures were developed utilizing these applications to evaluate semiconductor memory circuits. These procedures provide practical methods for developing die maps, electrical circuit schematics, logic diagrams, device block diagrams and memory array bit maps. The SEM data are used in conjunction with light microscopy data to provide significant improvements in device characterization. GRA

N81-13275# Teague (Ben), Athens, Ga.

BRIDGE CUTOUT, IN PARTICULAR FOR INCANDESCENT LAMPS TO BE CONNECTED IN SERIES

Otto Maresch and Franz Viehboeck 22 Jul. 1980 8 p Transl. into ENGLISH from Austrian Patent no. 180993 (10 Feb. 1955) 8 p

(Contract DE-AC04-78DP-00789)

(SAND-80-6017) Avail: NTIS HC A02/MF A01

The design of a bridge cutout for electrical devices to be connected in series is considered. The bridge cutout is characterized by the fact that as reducing agent for the metal oxide or the metal oxides, the mass contains one or more elements of groups 1 to 4 of the periodic system. DOE

N81-13276# Gould-Brown Boveri, Colmar, Pa.

SUPERCONDUCTING FAULT CURRENT LIMITER Quarterly Technical Progress Report, 8 Nov. 1979 - 7 Feb. 1980

1980 89 p refs

(Contract ET-78-C-01-3015)

(CONS-3015-T6; QTPR-6) Avail: NTIS HC A05/MF A01

Progress in developing an improved superconducting fault current limiter (SCFCL) is described. A mathematical model of the most promising SCFCL design was used for determining transient characteristics, thermal recovery characteristics, and for evaluating types of shunt resistors. Some experimental work was done on Nb3Sn film properties. DOE

N81-13277# Los Alamos Scientific Lab., N. Mex.

HIGH-FIELD BIPOLAR LOSS MEASUREMENT APPARATUS

D. Weldon, P. Thullen, and J. Wollan 1980 7 p refs Presented at the Appl. Superconductivity Conf., Santa Fe, N. Mex., 29 Sep. - 3 Oct. 1980

(Contract W-7405-eng-36)

(LA-UR-80-2774; CONF-800980-7) Avail: NTIS HC A02/MF A01

An apparatus was constructed to measure dissipation in superconducting wire in high alternating fields. The circuit incorporates a pair of locomotive traction motors as the capacitive circuit element for the bipolar swing. The design, construction and operating characteristics of the field coil and the associated circuitry are described. DOE

N81-13278# California Univ., Livermore. Lawrence Livermore Lab.

DRIVING PARALLEL FLASHLAMPS WITH A COMPENSATED PULSED ALTERNATOR

B. M. Carder, B. T. Merritt, W. L. Gagnon, W. L. Bird, W. F. Weldon, and R. C. Zowarka May 1980 20 p refs Presented at the 14th Pulse Power Modulator Symp., Orlando, Fla., 6 Jun. 1980 Prepared in cooperation with Texas Univ., Austin

(Contract W-7405-eng-48)

(UCRL-84042; CONF-800640-18) Avail: NTIS HC A02/MF A01

Results are given for a prototype compensated pulsed generator that was operated up to its 5400 rpm design speed. The machine has delivered approximately 140 kilojoules of energy in a single 1.3 millisecond pulse into a load comprising sixteen parallel flashlamps. The energy delivered to the lamps follows a W = (rpm/225 to the 4th power scaling law to about 4200 rpm. Beyond that speed, eddy current losses become significant with the present design. Various codes are able to model the machine parameters, and the prototype is presently being rebuilt to reduce the high speed losses predicted by the codes and verified by experiment. DOE

N81-13279# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Div.

BINARY AND TERNARY NIOBIUM-BASE SUPERCONDUCTORS BY THE INFILTRATION PROCESS Final Report

M. R. Pickus, J. T. Holthius, and M. Rosen Jun. 1980 71 p refs

(Contract W-7405-eng-48)

(LBL-11222) Avail: NTIS HC A04/MF A01

Two major interrelated focal points characterize this research. One was the decision to restrict the effort to A-15 compounds because of their superior critical temperatures and critical fields. The inherent brittleness of these compounds along with the requirement for a filamentary morphology led to the second focal point: a heavy reliance on a powder approach for the fabrication of superconducting tapes and wires. There were exceptions to the use of powder techniques where special circumstances such as the nature of a particular alloy system suggested an alternative approach. The quench-age technique described herein is an example of a nonpowder approach. Here the niobium-aluminum system is involved and the methodology is based on the fact that in a certain composition range a solid solution of aluminum in niobium is the stable phase at elevated temperatures, whereas at lower temperatures the stable phase is the desired A-15 compound. Additionally, niobium forms deformation twins which were found to be effective sites for the nucleation of the A-15 phase. DOE

N81-13280# General Cable Corp., Union, N. J.

DEVELOPMENT OF 500-kV ac CABLE EMPLOYING LAMINAR INSULATION OF OTHER THAN CONVENTIONAL CELLULOSIC PAPER Final Report

G. Bahder, G. S. Eager, Jr., J. J. Walker, and A. F. Dima Sep. 1980 138 p

(Contracts EX-76-C-01-1426; DE-AC01-76ET-29252)

(EPRI-EL-1518) Avail: NTIS HC A07/MF A01

The results of an investigation to develop a 500 kV ac laminar dielectric power cable and joint having insulation with lower losses than conventional cellulosic paper insulation are presented. Background information is presented on proposed low loss synthetic and composite synthetic/cellulosic paper insulations. From these studies, fibrous polypropylene paper tape and cellulosic paper-polypropylene film-cellulosic paper composite paper (PPP) were chosen. Extensive testing of handwrapped cable models fabricated with each type of tape served to eliminate the fibrous polypropylene paper tape from further consideration. Cable model tests indicate that the PPP tape is satisfactory for insulation in 500 kV ac cable, and that oil impregnants now used in conventional cellulosic paper insulated cables are unsuitable, but that silicone oil with an additive is satisfactory for PPP tapes. DOE

N81-13281# Rensselaer Polytechnic Inst., Troy, N. Y. Center for Electric Power Engineering.
FUNDAMENTALS OF INTERRUPTION IN VACUUM Progress Report
Allan N. Greenwood and Susan E. Childs 30 May 1980 16 p refs
(Contract DE-AS02-78ET-29197)
(DOE/ET-29197/8; PR-8) Avail: NTIS HC A02/MF A01

In analyzing the behavior of a vacuum arc during interruption, a mathematical model was set up to describe the events occurring in the interelectrode gap during interruption. The reliability of the results obtained using such a model depends on the accuracy of the initial assumptions made in setting up the model equations. Previous results compared to experimental data revealed a discrepancy close to current zero. Some of the original model assumptions have been reconsidered in order to make the model more closely represent the physical reality of a vacuum arc. DOE

N81-13282# National Bureau of Standards, Washington, D.C. National Engineering Lab.
MATERIALS STUDIES FOR SUPERCONDUCTING MACHINERY COIL COMPOSITES Interim Report
J. W. Ekin, M. B. Kasen, D. T. Read, R. E. Schramm, R. L. Tobler, and A. F. Clark Nov. 1979 163 p refs Sponsored in part by David W. Taylor Naval Ship Research and Development Center, Annapolis, Md.
(PB80-212202; NBSIR-80-1633) Avail: NTIS HC A08/MF A01 CSCL 09C

The physical properties of superconducting coil composite are studied to accurately predict the coil behavior under operating conditions. The effect of stress and strain on the critical current of superconducting wires is highlighted. Data on several fiberglass/epoxy support structures for the coil and its dewar are included. Preliminary results are given for the effect of stress on small superconducting composite rings used to model the full sized coil behavior. GRA

N81-13283 New Hampshire Univ., Durham.
ANALYSIS AND SIMULATION OF STEPPING MOTOR SYSTEMS USING A PHASE PLANE APPROACH Ph.D. Thesis
Raymond Gerard Gauthier 1980 317 p
Avail: Univ. Microfilms Order No. 8027789

A mathematical model for a class of stepping motors, the permanent magnet stepping motors is presented. Analysis reveals that a second order nonlinear model adequately describes the major failure modes for stepping motors. The phase plane, a plot of motor velocity versus position, is used to graphically display the computer solutions of the mathematical model. This method offers the advantage of organizing the solutions in a very compact format and brings order to an otherwise complex problem. By using the phase plane approach, one cannot only predict when the motor will fail, but optimum step sequences can be readily obtained by graphical means. The second order model is based on the assumption that the current rise time in the motor windings is insignificant compared to the one time of the windings. A more complex model which includes these effects is developed. This results in a third order nonlinear model, for which the phase plane is no longer adequate to display the solutions. It is then necessary to use a phase space or a three dimensional plot. Dissert. Abstr.

N81-13222*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TEMPERATURE CONTROL SIMULATION FOR A MICROWAVE TRANSMITTER COOLING SYSTEM
C. S. Yung *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 107-120 refs (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 09C

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N81-13284 Rochester Univ., N. Y.
COHERENT ANTI-STOKES RAMAN SCATTERING: SUPPRESSION OF THE NONRESONANT BACKGROUND CONTRIBUTION AND OBSERVATION OF BEATS BETWEEN ADIABATIC AND NON-ADIABATIC CONTRIBUTIONS Ph.D. Thesis
Mkankam Kamga 1980 154 p
Avail: Univ. Microfilms Order No. 8028911

The existence of a nonresonant contribution to the Coherent Anti-Stokes Raman Scattering is widely cited as the main disadvantage of CARS. This contribution is due to the nonlinear response of the electrons to applied fields (Kerr effect) as well as from other far away from resonance Raman modes. It interferes with resonant signal and leads to distorted lineshape. A pulse sequenced suppression technique using ultra-short dye laser pulses synchronously pumped and mode locked by an argon ion laser was developed. Unlike normal CARS, part of the pump beam is split delayed and used as a probe to generate the pulse sequenced CARS signal. All the intermediate transitions responsible for the nonresonant contribution involve virtual states. The delayed generation of the anti-Stokes signal in pulse sequenced CARS assured that virtual intermediate states will all have decayed and only the resonant processes, with real intermediate states, will contribute to CARS generation. Dissert. Abstr.

N81-13285 Illinois Univ. at Urbana-Champaign.
THREE DIMENSIONAL ANALYSIS OF BOUNDARY LAYERS IN MAGNETOHYDRODYNAMIC OPEN CHANNEL FLOW Ph.D. Thesis
Paul Robert Hays 1980 55 p
Avail: Univ. Microfilms Order No. 8026515

The pumping of liquid metals through open channels by MHD effects can be applied to slag separation or continuous casting processes by the metallurgy industry. This study involves the analysis of the boundary layer structure of nonuniform open channel flow in a rectangular channel, with perfectly conducting sidewalls, an insulating bottom, and a uniform magnetic field applied perpendicular to the bottom, the plane of which is sloped with respect to the horizontal. To supply the nontrivial three dimensional sidewall boundary layer structure a boundary value problem is posed and reduced to two integral equations coupled in two unknowns. The twenty four point Gauss Legendre quadrature scheme used to represent the integrals leads to a set of forty-eight simultaneous equations which is solved numerically for the unknowns. Once obtained, these unknowns are used in the numerical calculation of sample velocity profiles which illustrate and contrast MHD effects in open channel and closed duct flows. Dissert. Abstr.

N81-13286 Illinois Univ. at Urbana-Champaign.
PULSE PROPAGATION IN FLUID-FILLED ELASTIC CURVED TUBES Ph.D. Thesis
Chao-Kan Hu 1980 65 p
Avail: Univ. Microfilms Order No. 8026523

The propagation of fluid transients through elbows in pipes is an important consideration in the safety analysis of nuclear piping systems. One dimensional governing equations for the propagation of pressure pulses in an inviscid compressible fluid contained in a thin walled naturally curved elastic tube are formulated. The method of characteristics is used to solve the pulse propagation problems. A second order accurate integration scheme is employed. Classical waterhammer results for a fluid filled elastic tube are used as a check on the solutions, where appropriate. An experimental arrangement for pulse studies is described and experimental results are compared with numerical results from the method of characteristics. Finally, pertinent conclusions regarding the applicability of the governing equations are drawn. Dissert. Abstr.

N81-13287 Illinois Univ. at Urbana-Champaign.
***NUMERICAL ANALYSIS OF TWO AND THREE DIMENSIONAL 90 DEGREE BEND FLOW* Ph.D. Thesis**
Ren-Jei Liou 1980 143 p
Avail: Univ. Microfilms Order No. 8026548

The two basic methods of numerical viscous flow calculation, the vorticity transport and primitive-variable schemes, are applied to the finite-difference analysis of flow through a two dimensional 90 degree bend between sections of straight conduit. Additionally, the vorticity-transport method is employed in two approaches, one a direct calculation in rectangular and polar coordinates, the other via a nonorthogonal coordinate transform by which calculations are performed in a square mesh field. The solutions for all three methods were in agreement for R = 82. The two dimensional primitive variable methodology was then successfully transferred to the three dimensional 90 degree curved pipe problem. Dissert. Abstr.

N81-13288 Purdue Univ., Lafayette, Ind.
ANALYSIS OF STEADY, TWO DIMENSIONAL, CHEMICALLY *REACTING NONEQUILIBRIUM FLOW BY AN UNSTEADY,* ASYMPTOTICALLY CONSISTENT TECHNIQUE Ph.D. Thesis
Randall Jay Stiles 1980 176 p
Avail: Univ. Microfilms Order No. 8027342

A method was developed for solving the equations governing two dimensional, unsteady, chemically reacting nonequilibrium flow. Subsonic, transonic, and supersonic flow fields can be analyzed using this technique. The steady state solution is obtained as the asymptotic solution to the unsteady equations, with steady flow boundary conditions applied, for large time. Interior mesh points are computed using MacCormack's method while all boundary points are calculated by a reference plane characteristic scheme. The overall algorithm is inconsistent in time in the treatment of the species continuity equations but it becomes consistent at the steady state limit. The species continuity equations are integrated by a second order accurate implicit method along streamlines within the flow field. The technique allows the specification of nonuniform, nonequilibrium conditions at the nozzle inlet. A production type computer program was developed and was used to analyze several different problems including the effects of finite rate chemical kinetics.
Dissert. Abstr.

N81-13289 Purdue Univ., Lafayette, Ind.
COHERENT STRUCTURES IN THE SIMILARITY REGION OF A TWO-DIMENSIONAL TURBULENT JET: A VORTEX STREET Ph.D. Thesis
James Walter Oler 1980 194 p
Avail: Univ. Microfilms Order No. 8027318

The characteristics of the coherent structures of a plane jet were evaluated experimentally and with a kinematic numerical representation. Spatially coherent patterns within the turbulent velocity field were evaluated utilizing two point velocity correlation measurements. From these, it was found that the instantaneous velocity fluctuation distributions are antisymmetric with respect to the centerline and coherent over the entire width of the flow field. The two dimensionality of the large structures was evaluated through the comparison of longitudinal and vertical integral length scales derived from correlations in both the fully turbulent zone and the intermittent region. In the intermittent region, the integral scales were approximately equal while in the fully turbulent zone, the longitudinal scale was approximately double the vertical one. From the experimental results, a hypothetical vortex street representation of the plane jet was formulated and evaluated numerically. This kinematic representation was found to be capable of generating realistic distributions of mean longitudinal and lateral velocity as well as the proper spreading and velocity decay sites. Dissert. Abstr.

N81-13290 Yale Univ., New Haven, Conn.
A LIGHT SCATTERING TECHNIQUE FOR SIMULTANEOUS TWO-DIMENSIONAL GAS CONCENTRATION MEASUREMENTS Ph.D. Thesis
Marshall Bradford Long 1980 109 p
Avail: Univ. Microfilms Order No. 8026425

A technique was developed for instantaneous spatial mapping of the gas concentration in turbulent flows. The technique uses a computer controlled low light level TV camera to detect the elastically scattered radiation from aerosols introduced into the flow. If the aerosol seeding level is selected appropriately, it is possible to infer the gas concentration from the scattered light intensity. The ability to provide quantitative data, as well as visually interpretable results, makes the method particularly valuable for studying large scale structures. The technique was successfully applied to the study of mixing in the near field of an axisymmetric turbulent jet and the experimental results are presented. Dissert. Abstr.

N81-13291 Illinois Univ. at Urbana-Champaign.
FLUCTUATING VELOCITY-PRESSURE FIELD STRUCTURE IN A ROUND JET *TURBULENT MIXING REGION* Ph.D. Thesis
C. K. Nithianandan 1980 258 p
Avail: Univ. Microfilms Order No. 8026564

An experimental study of turbulent mixing was conducted to provide detailed insight regarding the turbulent transport processes, especially those involving pressure. The investigation was conducted in the mixing region of a 6.35 cm diameter, isothermal, stationary jet having an exit velocity of 91.4 m/s. The study involved the following related parts: (1) measurements of single-point pressure-velocity correlations and estimation of the error involved in these correlations due to the velocity contamination of the pressure probe; (2) measurements of the three velocity components simultaneously, in order to obtain higher order velocity correlations and to verify the similarity of these correlations so that similarity assumptions can be used in the turbulent kinetic energy balance and in turbulent modeling work; (3) estimation of two dimensional velocity vector patterns representing the large-scale coherent structures from the pressure-velocity correlation measurements using the linear estimation theory; (4) review and experimental verification of velocity and pressure spectra modeling theory based on dimensional analysis and extension of this study to include cross spectra of shear stress and pressure-velocity correlations; and (5) verification of the turbulent kinetic energy balance.
Dissert. Abstr.

N81-13292 Illinois Univ. at Urbana-Champaign.
NUMERICAL ANALYSIS OF HEAT AND MASS TRANSFER FROM BUBBLES, DROPS, AND RIGID SPHERES Ph.D. Thesis
Lonnie Sharpe, Jr. 1980 62 p
Avail: Univ. Microfilms Order No. 8026595

Steady state heat or mass transfer from spherical objects at low values of the Reynolds number is investigated. Heat or mass transfer to a drop in an electric field, to single translating bubbles, drops, and rigid spheres, and to rigid and fluid spheres in shear flow is considered. The energy equation is solved using finite difference techniques. A method known as upwind differencing is used in approximating the convective terms. Far from the sphere, a transmitting boundary condition is introduced; the dimensionless temperature is held zero for inward radial flow and the dimensionless temperature gradient is held zero for outward radial flow at a fixed distance from the sphere's surface. Heat transfer results are obtained for the creeping flow for Peclet numbers up to 1000. Dissert. Abstr.

N81-13293 Toledo Univ., Ohio.
BOUNDARY LAYER TRANSFER FOR NON-NEWTONIAN POWER-LAW FLUIDS OVER TWO DIMENSIONAL OR AXISYMMETRICAL BODIES Ph.D. Thesis
Hyun Wang Kim 1980 147 p
Avail: Univ. Microfilms Order No. 8029198

Momentum and heat transfer in laminar boundary layer over arbitrarily shaped, two dimensional or axisymmetrical bodies in nonNewtonian power law fluids were investigated. The analysis is also applicable to Newtonian fluid and thus embraces a great deal of fluids except some special types of nonNewtonian fluids, for example, Bingham plastic, time dependent nonNewtonian fluids, and viscoelastic fluids. Due to the power of n in the expression of shear stress, the analysis of boundary layers for power law fluids is much more complicated than that for Newtonian fluids. Dissert. Abstr.

N81-13294 *State Univ. of New York, Buffalo.*
STABILITY AND MEASUREMENTS OF FLUID AND THERMAL TRANSPORT IN VERTICAL BUOYANCY INDUCED FLOWS IN COLD WATER Ph.D. Thesis
Zatar Hameed Oureshi 1980 72 p
Avail: Univ. Microfilms Order No. 8027627

In pure water, the density entremum at 4 C is well known. The presence of a density extremum in the flow field was found to greatly modify the condition and the basic mechanisms of hydrodynamic instability. Buoyancy force reversal in the base flow further complicates the stability. However, there is no similarity solution for the base flow, with a reversal, for the uniform flux condition. Similarity results only when the quiescent medium is at the temperature condition at which the extremum occurs. However, for an isothermal surface a similarity base flow solution also exists for other ambient temperature conditions. The extremum temperature is both salinity and pressure dependent. An additional parameter q(s,p) in the formulation of base flow and stability equations represent this dependence. The disturbance vorticity and energy equations in linearized form were integrated numerically for two conditions--uniform flux and isothermal surface in ambient water at the temperature condition at which the extremum occurs. Dissert. Abstr.

N81-13295 *Oklahoma State Univ., Stillwater.*
AN INVESTIGATION OF THE EFFECT OF IMPROVED PHYSICAL PROPERTY DATA ON HEAT TRANSFER COEFFICIENT PREDICTION Ph.D. Thesis
Mitri S. Najjar 1980 197 p
Avail: Univ. Microfilms Order No. 8027201

The present investigation was undertaken to study the effects well defined physical properties for pure components and/or mixtures have on estimates of the heat transfer coefficient. Experimental studies were made with water, methanol, toluene, 85 wt % ethylene glycol-water mixture, 50 wt % ethylene glycol-water mixture, heavy oil coker, 30 wt % diethanolamine-water mixture, and n-octane in turbulent flow in an electrical-resistance-heated tube. For the heavy oil coker system, runs were also taken in laminar flow for the thermally developing regions. Local heat transfer coefficients were obtained around the periphery of the horizontal straight test section of the tube. Experimental heat transfer coefficients were compared with those predicted from literature using different sets of physical property data. The study has covered Reynolds numbers from 52 to 60,500 and Prandtl numbers from 5.3 to 1,570. Dissert. Abstr.

N81-13296 Northwestern Univ., Evanston, Ill.
MODELING OF COALESCENCE AND OF TWO-PHASE FLOW IN POROUS MEDIA Ph.D. Thesis
Cheng-Yuan Lin 1980 208 p
Avail: Univ. Microfilms Order No. 8026858

A hydrodynamic theory is developed for the drainage of a liquid film between a small bubble and a solid surface for both pure and surfactant systems. It describes the time rate of change of the film profile, given only the bubble radius and the required physical properties. It is concluded that, even with only a trace of surfactant present, the liquid gas interface may be nearly immobile and the surface viscosities have little effect upon the drainage rate. The drainage of a liquid film between a small drop or bubble and a fluid-fluid interface is analyzed for the case of immobile interfaces. The time rate of change of the film configuration is predicted, given only the drop radius and the required physical properties. A three dimensional, randomized network model is constructed. The pores in the network are assumed to be geometrically similar and their radii are sinusoidal functions of axial position. The atoms of nodes in the network are considered conceptual points of interconnections with zero volumes or resistence to flow. The randomized network is constructed by blocking a portion of pores in a regular network. Dissert. Abstr.

N81-13297 State Univ. of New York, Buffalo.
EXPERIMENTAL INVESTIGATION OF THE AXISYMMETRIC TURBULENT BUOYANT PLUME Ph.D. Thesis
Paul Douglas Beuther 1980 156 p
Avail: Univ. Microfilms Order No. 8027592

The investigation consists of a detailed experimental study of the turbulent energy balance and eddy structure in a turbulent axisymmetric hot air plume in a stably stratified environment. Data is obtained at various positions in the plume for exit flow conditions corresponding to a densimetric Froude number of about unity. The measurement techniques use hot wire anemometry methods to produce instantaneous velocity and temperature signals which are simultaneously sampled using an analog to digital converter. Data is acquired and analyzed using an on line PDP 11 minicomputer. A computer controlled traversing apparatus is utilized to simplify data acquisition. Measurements are taken of the turbulent and mean quantities needed to specify the energy budget. Also acquired are the power spectral densities, and single and joint probability of velocity and temperature. Whether or not local isotropy exists at small scales is determined and the applicability of Taylor's hypothesis to the dissipative scales is tested. The data is compared with current computer models to verify their credibility. From these measurements and models the structural characteristics of the turbulence are inferred. Dissert. Abstr.

N81-13298 *Colorado State Univ., Fort Collins.*
TURBULENT FLOW IN A RECTANGULAR CAVITY Ph.D. Thesis
Nsim Israel Hazan 1980 139 p
Avail: Univ. Microfilms Order No. 8028742

Turbulent flow in a rectangular cavity cut in the floor of a wind tunnel and approached by a turbulent boundary layer was investigated. It was found that at Re = 5000 to 50,000 (defined by the cavity depth and the free stream velocity) and aspect ratio (width/depth) of 1.0 to 3.0, the flow is two dimensional and the main vortex which is formed inside the cavity is nearly circular. For this flow case analytical models were proposed for the free shear layer which springs from the upstream upper corner of the cavity and for the circular vortex. It was established that if the turbulence in the free shear layer is modeled by a gradient model then its velocity field is similar whenever the approach flow has the form of a power law profile. For this flow case a numerical solution for the velocity field was obtained. The turbulence in the circular vortex was assumed to be similar with respect to its radius, which facilitated a closed form solution for this region of the flow. The results of the analytical models agreed within 25% error with the measurements for cavities of aspect ratio of 1.5 to 3.0. Dissert. Abstr.

N81-13299 Florida Univ., Cape Kennedy.
THE STRUCTURE OF VELOCITY AND DENSITY INTERFACES IN A WEAKLY TURBULENT STRATIFIED SHEAR FLOW Ph.D. Thesis
Gregory Merlin Powell 1980 227 p
Avail: Univ. Microfilms Order No. 8029081

The mixing region between two parallel and homogeneous streams of fluid having different densities and velocities was investigated. The flow was produced in a flume with a test section 24.38 m long, 1.22 m high and 0.61 m wide by pumping the upper 0.61 m deep layer in a closed circuit. The density of each layer was controlled by the addition of sodium chloride in such a manner that the lower layer was about 2.5 percent denser than the upper layer. Tests were conducted at two downstream locations and at several velocities between 27 cm/sec and 7.8 cm/sec. The mean velocity and the fluctuating velocity components were measured with hot film anemometers while the density structure was measured with a high resolution conductivity probe. Profiles of mean velocity viscous stress, and Reynolds stress were obtained through the mixing region. Energy spectra of the fluctuating velocity components were also obtained at several points within the region and under several flow conditions. Dissert. Abstr.

N81-13300 Portland State Univ., Oreg.
STUDIES OF HOMOGENEOUS NUCLEATION AND TRANSIENT HEAT TRANSFER IN CRYOGENIC LIQUIDS Ph.D. Thesis
Dipen N. Sinha 1980 208 p
Avail: Univ. Microfilms Order No. 8027382

Results are reported for a series of experimental studies in two interrelated areas: homogeneous nucleation and transient heat transfer in cryogenic liquids. Measurements of the homogeneous nucleation temperature for both liquid helium 1 and nitrogen are in good agreement with the predictions from the Becker-Doring

Volmer-Zel'dovich-Frenkel nucleation theory. On the basis of such agreement between theory and experiment in both liquid helium and liquid nitrogen a corresponding state analysis applicable to the case of homogeneous nucleation in liquid noble gases was developed. Predictions of the homogeneous nucleation temperature and surface tension of several hydrogen isotopes are made from such a quantum mechanical law of corresponding states. It is suggested that a comparison between the limiting superheat temperature and the peak nucleate boiling temperature is meaningless and that the reported agreement between the two is largely fortuitous. In the studies of transient heat transfer in helium, it was found that the heat transfer from a solid into liquid helium is markedly enhanced by the application of a visible pulse of light. Dissert. Abstr.

N81-13301*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ANALYSIS FOR PREDICTING ADIABATIC WALL TEMPERATURES WITH SINGLE HOLE COOLANT INJECTION INTO A LOW SPEED CROSSFLOW

C. R. Wang, S. S. Papell, and R. W. Graham 1981 10 p, refs Proposed for presentation at the 26th Ann. Intern. Gas Turbine Conf., Houston, Tex., 8-12 Mar. 1981
(NASA-TM-81620; E-628) Avail: NTIS HC A02/MF A01 CSCL 20D

Assuming the local adiabatic wall temperature equals the local total temperature in a low speed coolant mixing layer, integral conservation equations with and without the boundary layer effects are formulated for the mixing layer downstream of a single coolant injection hole oriented at a 30 degree angle to the crossflow. These equations are solved numerically to determine the center line local adiabatic wall temperature and the effective coolant coverage area. Comparison of the numerical results with an existing film cooling experiment indicates that the present analysis permits a simplified but reasonably accurate prediction of the centerline effectiveness and coolant coverage area downstream of a single hole crossflow streamwise injection at 30 degree inclination angle. Author

N81-13302*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

HEAT TRANSFER COEFFICIENTS FOR STAGGERED ARRAYS OF SHORT PIN FINS

G. James VanFossen 1981 15 p refs Proposed for presentation at the 26th Ann. Intern. Gas Turbine Conf., Houston, Tex., 8-12 Mar. 1981; sponsored by the ASME
(NASA-TM-81596; E-658) Avail: NTIS HC A02/MF A01 CSCL 20D

Short pin fins are often used to increase that heat transfer to the coolant in the trailing edge of a turbine blade. Due primarily to limits of casting technology, it is not possible to manufacture pins of optimum length for heat transfer purposes in the trailing edge region. In many cases the pins are so short that they actually decrease the total heat transfer surface area compared to a plain wall. A heat transfer data base for these short pins is not available in the literature. Heat transfer coefficients on pin and endwall surfaces were measured for several staggered arrays of short pin fins. The measured Nusselt numbers when plotted versus Reynolds numbers were found to fall on a single curve for all surfaces tested. The heat transfer coefficients for the short pin fins (length to diameter ratios of 1/2 and 2) were found to be about a factor of two lower than data from the literature for longer pin arrays (length to diameter ratios of about 8). Author

N81-13303*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

EVALUATION OF FLOW QUALITY IN TWO LARGE NASA WIND TUNNELS AT TRANSONIC SPEEDS

William D. Harvey, P. Calvin Stainback, and F. Kelvin Owen (COMPLERE Inc., Palo Alto, Calif.) Dec. 1980 76 p refs
(NASA-TP-1737; L-13448) Avail: NTIS HC A05/MF A01 CSCL 20D

Wind tunnel testing of low drag airfoils and basic transition studies at transonic speeds are designed to provide high quality aerodynamic data at high Reynolds numbers. This requires that the flow quality in facilities used for such research be excellent. To obtain a better understanding of the characteristics of facility disturbances and identification of their sources for possible facility modification, detailed flow quality measurements were made in two prospective NASA wind tunnels. Experimental results are presented of an extensive and systematic flow quality study of the settling chamber, test section, and diffuser in the Langley 8 foot transonic pressure tunnel and the Ames 12 foot pressure wind tunnel. Results indicate that the free stream velocity and pressure fluctuation levels in both facilities are low at subsonic speeds and are so high as to make it difficult to conduct meaningful boundary layer control and transition studies at transonic speeds. E.D.K.

N81-13304*# Sigma Research, Inc., Richland, Wash.

HIGH-PERFORMANCE HEAT PIPES FOR HEAT RECOVERY APPLICATIONS Final Report

E. W. Saaski and J. H. Hartl Aug. 1980 80 p refs
(Contract NAS5-25357)
(NASA-CR-163816) Avail: NTIS HC A05/MF A01 CSCL 20D

Methods to improve the performance of reflux heat pipes for heat recovery applications were examined both analytically and experimentally. Various models for the estimation of reflux heat pipe transport capacity were surveyed in the literature and compared with experimental data. A high transport capacity reflux heat pipe was developed that provides up to a factor of 10 capacity improvement over conventional open tube designs; analytical models were developed for this device and incorporated into a computer program HPIPE. Good agreement of the model predictions with data for R-11 and benzene reflux heat pipes was obtained. A.R.H.

N81-13305# Central Electricity Research Labs., Leatherhead (England). Thermodynamics Section.

MEASURING TECHNIQUES IN TRANSONIC AND SUPERSONIC CASCADE FLOW

N. B. Wood, ed. and M. J. Moore, ed. 12 Sep. 1979 274 p refs Symp. held at Leatherhead, Surrey, England, 22-23 Mar. 1979
(RD/L/N-166/79) Avail: NTIS HC A12/MF A01

Various cascade probes and their calibration are discussed as well as techniques for (1) determining aerodynamics and heat transfer in transonic cascades; (2) detecting boundary layer transition on a gas turbine blade; and (3) measuring transonic flow in a two-dimensional nozzle. The effect of aspect ratio on loss, deflection and pressure distribution measurements of two compressor cascades, linear cascade in the transonic velocity range, and the influence of secondary flow on the downstream flow angle of 2D cascades are examined. Three dimensional and unsteady flow, laser velocimetry, and the simulation of wet stream turbine flow are also discussed. A.R.H.

N81-13306# Cambridge Univ. (England).

SPONTANEOUS CONDENSATION OF STEAM IN SUPERSONIC NOZZLES. PART 1: NUCLEATION AND DROPLET GROWTH THEORY. PART 2: NUMERICAL METHODS AND COMPARISON WITH EXPERIMENTAL RESULTS

J. B. Young 1980 94 p refs
(CUED/A-Turbo/TR-97-Pt-1/2; ISSN-0309-6521) Avail: NTIS HC A05/MF A01

The nucleation and droplet growth characteristics of the condensation of pure steam in high speed nozzles are described. Various forms of droplet growth equations are considered. For individual titles, see N81-13307 through N81-13308.

N81-13307# Cambridge Univ. (England).

NUCLEATION AND DROPLET GROWTH THEORY

In its Spontaneous Condensation of Steam in Supersonic Nozzles, Pt. 1 and 2 1980 33 p refs (For primary document see N81-13306 04-34)
Avail: NTIS HC A05/MF A01

Various theories of nucleation and droplet growth are outlined. It is suggested that the classical nucleation equation, corrected for nonisothermal effects, is an accurate representation of reality. However, it is shown that the droplet growth equations must be substantially modified if they are to predict the growth rates observed in practice. A theory is developed whereby the evaporation coefficient falls below the condensation coefficient as the droplet vapour system departs from equilibrium. Two

integral forms of the equations are obtained: one pertains to freshly nucleated droplets and the other is for use with larger, established droplets. These integrated forms allow of a considerable improvement in the computational time of wet steam flows. R.C.T.

N81-13308# Cambridge Univ. (England).
NUMERICAL METHODS AND COMPARISON WITH EXPERIMENTAL RESULTS
In its Spontaneous Condensation of Steam in Supersonic Nozzles, Pt. 1 and 2 1980 41 p refs (For primary document see N81-13306 04-34)
Avail: NTIS HC A05/MF A01

The numerical solution of the gas dynamic equations are reported and a comparison of the theory with experimental results is given. The gas dynamic equations are presented in integral form wherever possible and this permits a rapid numerical marching scheme with comparatively large step sizes to be employed. The equation of state (of virial form) predicts property values throughout the range 0 - 100 bar with an accuracy which is never less than 0.1%. In order to test the theory it is applied to all the available experimental condensation shock data reported in the literature. With very few exceptions (all of which are of doubtful experimental validity) it is found that the entire range of data can be correlated extremely accurately if it is assumed that the condensation coefficient decreases with increasing pressure. R.C.T.

N81-13309# Pennsylvania State Univ., University Park.
THE USE OF FLUORESCENT MINI-TUFTS FOR HYDRODYNAMIC FLOW VISUALIZATION
A. L. Treaster and D. R. Stinebring 29 Jan. 1980 13 p ref (Contract N00024-79-C-6043)
(AD-A091050; ARL/PSU/TM-80-07) Avail: NTIS HC A02/MF A01 CSCL 20/4

A new flow visualization technique was demonstrated in the 12 inch (0.305 m) and 48 inch (1.22 m) diameter water tunnels of the Applied Research Laboratory at The Pennsylvania State University (ARL/PSU). The technique features the application of large numbers of extremely fine nylon monofilament fiber tufts to a model's surface. The fibers are treated with a fluorescent dye and rendered visible by ultraviolet light. GRA

N81-13310# Scientific Research Associates, Inc., Glastonbury, Conn.
COMPUTATION OF THREE DIMENSIONAL HORSESHOE VORTEX FLOW USING THE NAVIER-STOKES EQUATIONS
W. Roger Briley and Henry McDonald 1980 9 p refs Presented at the 7th Intern. Conf. on Numerical Methods in Fluid Dyn., 23-27 Jun. 1980
(Contract N00014-77-C-0075)
(AD-A090802) Avail: NTIS HC A02/MF A01 CSCL 20/4

Numerical solutions of the compressible Navier-Stokes equations are presented for a laminar horseshoe vortex flow created by the interaction of a boundary layer on a flat surface and an elliptical strut leading edge mounted normal to the flat surface. The computational approach utilizes zone embedding, surface-oriented elliptic-cylindrical coordinates, interactive boundary conditions, and a consistently-split linearized block implicit (LBI) scheme developed by the authors. Mesh resolution tests are performed, and the horseshoe vortex flow is discussed. GRA

N81-13311# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
HEAT AND MASS TRANSFER FROM FREELY FALLING DROPS AT LOW TEMPERATURES
John P. Zarling Aug. 1980 22 p refs
(DA Proj. 4A7-62730-AT-42)
(AD-A090522; CRREL-80-18) Avail: NTIS HC A02/MF A01 CSCL 07/4

The use of ice as a structural material is common practice for certain applications in cold regions. Techniques such as surface flooding or water spraying are used to accelerate ice growth rates, thereby lengthening the winter construction season. This report examines the heat and mass transfer rates from freely falling water drops in cold air. Design equations which predict the amount of supercooling of the drops as a function of outdoor ambient temperature, drop size and distance of fall are given. GRA

N81-13312# ARO, Inc., Arnold Air Force Station, Tenn.
ANALYTICAL APPROXIMATION OF TWO DIMENSIONAL SEPARATED TURBULENT BOUNDARY LAYER VELOCITY PROFILES Final Report, 1 Oct. 1978 - 15 Apr. 1979
T. W. Swafford AEDC Oct. 1980 25 p refs Sponsored by AF
(AD-A091204; AEDC-TR-79-99) Avail: NTIS HC A02/MF A01 CSCL 20/4

A single analytical expression is proposed to describe the velocity distribution in a two dimensional, separated, turbulent boundary layer on smooth, impermeable, adiabatic walls over the domain 0 less than or equal to y less than infinity. The expression is an extension of one previously derived for attached flow which depends upon local values of skin friction, shape factor, and Reynolds number based on momentum thickness. Boundary-layer shape factor and local skin friction correlations applicable to separated flows are derived from fitting the proposed analytical expression for separated velocity profiles to available experimental data. These correlations are then available for analytically describing separated velocity profiles without further fitting. GRA

N81-13313# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Aeronautical and Astronautical Engineering.
GAS FLOW RESISTANCE MEASUREMENTS THROUGH PACKED BEDS AT HIGH REYNOLDS NUMBERS Interim Technical Report, Jul. 1978 - May 1980
Stephen F. Wilcox and Herman Krier Mar. 1980 94 p refs (Grant AF-AFOSR-3336-77; AF Proj. 2308)
(AD-A091300; AAE-80-1; UILC-ENG-80-0501; AFOSR-80-1063TR) Avail: NTIS HC A05/MF A01 CSCL 20/4

This work reviews the literature on gaseous flow pressure resistance in packed beds and finds important differences depending on test conditions and Reynolds number ranges. A test apparatus was constructed which allowed for the testing over a wide range of pressures, test conditions, and Reynolds number range several orders of magnitude higher than previously tested. From the resulting data it was ascertained that the classical Reynolds number dependency of the coefficient of drag is not correct for Reynolds numbers greater than 1000. A new correlation for the coefficient of drag was developed, which indicated that a new factor, the kinetic energy of the gases being forced through the bed, must be taken into account. This formula was shown to be valid for a Reynolds number range 1,000 - 100,000, for particles ranging in diameter from 1 mm through 6 mm. This correlation of transient two-phase flows at high pressures is needed in the modeling effort for deflagration-to-detonation (DDT) in granular beds of propellant. GRA

N81-13314# California Inst. of Tech., Pasadena.
THE PLANE MIXING LAYER FLOW VISUALIZATION RESULTS AND THREE DIMENSIONAL EFFECTS
A. Roshko 1980 19 p refs Presented at the Intern. Conf. on the Role of Coherent Struct. in Modelling Turbulence and Mixing, Madrid, 25-27 Jun. 1980
(Contract N00014-76-C-0260)
(AD-A090847) Avail: NTIS HC A02/MF A01 CSCL 20/4

The turbulent mixing layer between two streams of different velocities continues to play a central role in research aimed at improved understanding of turbulent shear flows in general. At present, not all researchers are in agreement as to what various experiments imply about the structure of mixing layers at high Reynolds number. The views which are held differ on the question as to how and to what extent three dimensionality develops in these flows and whether the characteristic spanwise organized large vortex structures (rollers) continue to be a dominant feature. The traditional view, as extended to the contemporary scene, is that ultimately (i.e., sufficiently far downstream or at sufficiently high Reynolds number) the flow will be completely disorganized. The view put forward by 'eddy chasers' is that such vortex structures are primary elements, characteristic of the underlying mean vorticity field, which is particularly simple for the mixing

layer, and that, as long as the velocity difference is maintained, there is a mechanism to regenerate these primary structures by what, for convenience, may be called a Kelvin-Helmholtz instability. The heart of the controversy then is whether, or to what extent, secondary and higher instabilities will ultimately break down, completely disorganize or prevent formation of organized primary structures. In a plane mixing layer, the primary structures would, ideally, be two dimensional, containing the basic single component of vorticity while secondary and higher modes of instability would introduce three dimensionality and the other two components of vorticity into the flow. GRA

N81-13315# Air Force Weapons Lab., Kirtland AFB, N. Mex.
A TWO DIMENSIONAL COMPUTATION RIBBED PIPE FLOW Final Report
J. Douglas Beason and C. E. Needham Apr. 1980 61 p refs
(AD-A090955; AFWL-TR-79-65) Avail: NTIS HC A04/MF A01 CSCL 20/4

The study of ribbed pipe flow is currently of great interest to several diverse groups. Unlike smooth pipe flow which has been studied in great depth, ribbed pipe flow is relatively new to experimental, analytic and computational research efforts. A recent computer simulation of ribbed pipe flow was made by the Air Force Weapons Laboratory using a two dimensional, Eulerian finite difference hydrodynamic computer code. Two separate experiments were modeled using a coarse (0.13 cm x 0.78 cm) and a very fine (0.065 cm x 0.065 cm) zone calculation. The two dimensional calculations used one dimensional input, obtained from a highly successful earlier effort to model smooth pipe flow. The one dimensional input closely matched the smooth true calibration performed prior to the ribbed pipe experiment. Computational flow patterns and pressure waveforms were compared to pictures of holographs of the experimental flow and also to pressure waveforms obtained from the various gauges. Individual shocks and vortices could be matched very well, as well as the pressure waveforms. GRA

N81-13316# Michigan Univ., Ann Arbor. Radiation Lab.
ANALYSIS FOR COHERENT ANTI-STOKES RAMAN SPECTROSCOPY (CARS) Final Report, 1 Jan. - 30 Jun. 1980
Herschel Weil Jun. 1980 39 p refs
(Grant AF-AFOSR-0106-80)
(AD-A091087; Rept-017896-1-F; AFOSR-80-0107TR) Avail: NTIS HC A03/MF A01 CSCL 07/4

Coupled differential equations have been formulated which model the generation of coherent anti-Stokes Raman radiation in molecular gases. The equations include not only the basic term which involves the coherent interaction of incident pump and idler (Stokes) waves to generate the anti-Stokes radiation, but also include additional terms which model other radiation and absorption processes, both stimulated and coherent, which occur simultaneously. These are important in determining saturation effects due to population depletion of the lowest energy level. Other effects have also been considered. These are a finite idler beam bandwidth (simultaneous excitation of more than one vibration frequency) a quasi-monochromatic idler beam slightly off the true Stokes frequency; laser pulse shape; modification of the result for different rotational levels. A number of different computer codes have been developed to solve the equations at different levels of complexity. With them numerical investigation of the effects of various physical factors on saturation was carried out. Some of the results are presented graphically. GRA

N81-13317# Sandia Labs., Livermore, Calif. Applied Physics Div.
CROSSED-BEAM, BACKGROUND-FREE CARS MEASUREMENTS IN A METHANE DIFFUSION FLAME
R. L. Farrow, P. L. Mattern, and L. A. Rahn Jun. 1980 17 p refs Presented at the 7th Intern. Conf. on Raman Spectry., Ottawa, Canada, 4-9 Aug. 1980 Sponsored by DOE
(SAND-80-9640; CONF-800808-4) Avail: NTIS HC A02/MF A01

Background free coherent anti-Stokes Raman spectra of CO, N2, and H2 were obtained in a diffusion flame using a crossed beam, phase matched geometry. The spatial resolution of the experiment made possible the observation of rapid changes in density and temperature as a function of position in the flame. The use of background rejection and a three dimensional phase matching configuration permitted photon limited detection of measured species. Preliminary results are reported that demonstrate an enhanced signal to noise ratio and an increase in spatial resolution in comparison with conventional CARS experiments. A.R.H.

N81-13318# Sandia Labs., Livermore, Calif. Combustion Application Div.
THE IMPULSIVELY STARTED INCOMPRESSIBLE TURBULENT JET
Peter O. Witze Oct. 1980 15 p refs Sponsored by DOE
(SAND-80-8617) Avail: NTIS HC A02/MF A01

Hot film anemometer measurements are presented for the centerline velocity of a suddenly started jet of air. The tip penetration of the jet is shown to be proportional to the square root of time. A theoretical model is developed that assumes the transient jet can be characterized as a spherical vortex interacting with a steady state jet. The model demonstrates that the ratio of nozzle radius to jet velocity defines a time constant that uniquely characterizes the behavior and similarity of impulsively started incompressible turbulent jets. DOE

N81-13319# Los Alamos Scientific Lab., N. Mex.
HYDROGEN MIXING IN A CLOSED CONTAINMENT COMPARTMENT BASED ON A 1D MODEL WITH CONVECTIVE EFFECTS Final Report
G. J. E. Willcutt, Jr., R. G. Gido, and A. Koestel 1980 14 p refs Presented at the ANS/ASME Topical Meeting on Reactor Thermal-Hydraulics, Saratoga, N.Y., 6-8 Oct. 1980
(Contract W-7405-eng-36)
(LA-UR-79-3019; CONF-801002-5) Avail: NTIS HC A02/MF A01

A transient one dimensional finite-difference model was developed to determine the hydrogen concentration variation with position in a closed containment compartment due to radiolysis following a LOCA. The model includes mixing due to molecular and eddy diffusion and natural convection. For representative compartments, the maximum hydrogen concentration difference between the bottom and top of the compartment never exceeds 0.25 volume percent when all three mixing mechanisms are considered for a range of parameters. DOE

N81-13320# California Univ., Livermore. Lawrence Livermore Lab.
UNSTEADY BOUNDARY-LAYER FLOWS IN COMBUSTION ENVIRONMENTS
S. W. Kang and J. L. Levatin Aug. 1980 10 p refs Presented at the 17th JANNAF Combust. Meeting, Hampton, Va., 22-26 Sep. 1980
(Contract W-7405-eng-48)
(UCRL-84311; CONF-800956-1) Avail: NTIS HC A02/MF A01

Current progress is described in the calculation of non-steady boundary layers connected with internal flows for the purpose of discovering the principal wall erosion mechanisms. A time dependent system of equations describing the laminar and turbulent viscous layer is solved numerically by means of an alternating direction implicit (ADI) scheme for prescribed transient and streamwise varying core flow conditions. Validity of the method is demonstrated by comparison of present results with those obtained by previous analyses. Earlier calculations of compressible turbulent flow cases showed that high heat fluxes at the wall due to turbulence and changing core conditions could bring about severe temperature rise at the wall. Present results indeed display a marked rise in wall temperature which may cause melting and ablation, and hence erosion of the surface. DOE

N81-13321# Oak Ridge Gaseous Diffusion Plant, Tenn. Computer Sciences Div.
APPLICATION OF THE FINITE ELEMENT METHOD TO THE TWO-DIMENSIONAL NONLINEAR INVERSE HEAT CONDUCTION PROBLEMS
B. R. Bass and L. J. Ott 1980 14 p refs Presented at the 1st Intern. Conf. on Numerical Methods for Nonlinear Probl., Swansea, England, 2-5 Sep. 1980
(Contract W-7405-eng-26)

(K/CSD/INF-79/22; CONF-800916-1) Avail: NTIS HC A02/MF A01

The calculation of the surface temperature and surface heat flux from measured temperature transients at one or more interior points of a body is identified as the inverse heat conduction problem. An inverse solution technique applicable to the two dimensional nonlinear model with temperature dependent thermophysical properties is presented. The technique utilizes a finite element heat conduction model and a generalization of Beck's one dimensional nonlinear estimation procedure. The inverse formulation is capable of treating experimental data.DOE

N81-13322# Sandia Labs., Albuquerque, N. Mex.
REENTRY-VEHICLE FLIGHT TESTING AND RECOVERY TECHNIQUES
Donald J. Rigali, Marlyn W. Sterk, and Juri Randmaa (Air Force Ballistic Missile Office, Norton AFB, Calif.) 1980 12 p Presented at the 15th AIAA Thermophys. Conf., Snowmass, Colo., 14-16 Jul. 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-1648C) Avail: NTIS HC A02/MF A01

A technique to soft-recover high ballistic coefficient reentry vehicles from ICBM reentry conditions was developed and demonstrated. To date, two different types of vehicles were soft-recovered, utilizing the mass jettison, parachute recovery technique described herein. The fabrication and assembly of two additional RVs of different designs are presently underway in preparation for flight test. A technique to allow an increase in the severity of the environment from which an RV can be recovered is presently being analyzed and ground tested with plans to flight test it within two years. Descriptions of all of these vehicles and a summary of the flight test results are presented. DOE

N81-13323# Sandia Labs., Albuquerque, N. Mex.
THERMAL CONVECTION AT LOW RAYLEIGH NUMBER FROM CONCENTRATED SOURCES IN POROUS MEDIA
Charles E. Hickox 1980 29 p refs Presented at Heat Transfer in Nucl. Waste Disposal, ASME Winter Ann. Meeting, Chicago, 16 Nov. 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-0426C; CONF-801102-9) Avail: NTIS HC A03/MF A01

A simple mathematical theory is proposed for the analysis of natural convective motion, at low Rayleigh number, from a concentrated source of heat in a fluid-saturated porous medium. The theory consists of retaining only the leading terms of series expansions of the dependent variables in terms of the Rayleigh number, is thus linear, and is valid only in the limit of small Rayleigh number. Based on fundamental results for a variety of isolated sources, superposition is used to provide solutions for situations of practical interest. Special emphasis is given to the analysis of sub-seabed disposal of nuclear waste. DOE

N81-13324# Sandia Labs., Albuquerque, N. Mex. Dept. of Fluid and Thermal Sciences.
NUMERICAL STUDY OF NATURAL CONVECTION IN A HORIZONTAL POROUS LAYER SUBJECTED TO AN END-TO-END TEMPERATURE DIFFERENCE
C. E. Hickox and D. K. Gartling 1980 31 p refs Presented at the ASME Winter Ann. Meeting, Chicago, 16-21 Nov. 1980
(Contract EY-76-C-04-0789)
(SAND-79-2377C; CONF-801102-2) Avail: NTIS HC A03/MF A01

A numerical study of steady, natural convection in a fluid-saturated, horizontal, porous layer subjected to an end-to-end temperature difference is reported. A finite element computer program based on the Galerkin form of the finite element method is used. Heat transfer rates are predicted for aspect ratios ranging from 0.1 to 0.5 and Rayleigh numbers in the range 25 to 200. Representative plots of temperature and velocity fields are presented. Comparisons are made with an approximate analytical solution and regions of validity are identified for the analytical solution. DOE

N81-13325# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
THE FOCUSING OF A WEAK SHOCK AT AN AXISYMMETRIC ARETE
M. S. Cramer Aug. 1980 46 p refs
(Grant NSF eng-79-11888)
(PB80-217318; VPI-E-80-21) Avail: NTIS HC A03/MF A01 CSCL 20D

The focusing of a weak and nearly plane shock at an axisymmetric arete is described. The initial value problem governing the flow in the vicinity of the arete is obtained. The initial condition for this problem is derived by the method of matched asymptotic expansions. The principal result is that the pressure levels in the focal region are proportional to a parameter characterizing the rate at which the shock focuses and to the square root of a parameter measuring the initial strength of the shock. GRA

N81-13326 Illinois Univ. at Urbana-Champaign.
SCALING AND PERFORMANCE OF A DEVICE FOR FLUIDIZED BED ENTRAINMENT REDUCTION Ph.D. Thesis
James Henry Saunders, Jr. 1980 194 p
Avail: Univ. Microfilms Order No. 8026586

A device recently proposed for entrainment suppression from a fluidized bed was studied. Particles projected upward at the bed surface entered a particle diverter which returned them to the bed. Relations were proposed for scaling the particle mass flux field above the device. Experimental studies were done on two geometrically similar flow systems, using fluidized beds with diameters of 9.5 cm and 33.3 cm. Measurements were made of the particulate mass flux and gas velocity in the dilute phase. A probe was developed which determined the particle mass flux by counting electrical pulses produced when particles collided with a metal sensor placed in the flow stream. Air velocity was measured with a rugged hot film anemometer. The particle mass flux field in the large system was predicted adequately from measurements made in the small system by utilizing the scaling relations. In addition, use of the device resulted in a significantly lower transport disengaging height and a steadier flow than an ordinary fluidized bed. Dissert. Abstr.

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N81-13327*# National Aeronautics and Space Administration, Washington, D. C.
METHOD AND RESULTS OF INTERPRETING GRADUATED MEASUREMENTS OF WIDE GAP SPARK CHAMBERS
V. V. Akimov, G. V. Veselova, and V. D. Kozlov Oct. 1980 27 p refs Transl. into ENGLISH of "Metodika i Rezultaty Obrabotki Graduirovochnykh Izmeriniy Shirokozazornykh Iskrovyky Kamer", Rept. Pr-406 Academy of Sciences USSR, Inst. of Space Research, 1978 p 1-26 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76244; Pr-406) Avail: NTIS HC A03/MF A01 CSCL 14B

Measurement of gamma ray telescope plates is discussed. The graduated measurements of the angular resolution of wide gap spark chambers using photographic, video and vidicon information gathering schemes are presented. Author

N81-13328# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Technische Physikalische
CONSTRUCTION AND PROPERTIES OF A QUADRUPOLE MASS SPECTROMETER DEVICE, DEVELOPED FOR THE ATMOSPHERE AND ITS INFLUENCES IN A THERMIONIC BARIUM-CESIUM-DIODE
Dieter Mahr Mar. 1979 110 p refs In GERMAN; ENGLISH summary

(DFVLR-FB-79-39) Avail: NTIS HC A06/MF A01

The construction and operation characteristics are described for a self-developed device for investigating and analyzing the atmosphere of a Ba-Cs-thermionic diode by means of a quadrupole mass spectrometer. By means of simultaneous measurement, the current-voltage characteristics of the diode, the vapor gas composition in the diode, and performance in the atmosphere can be observed. The atmospheric composition required for optimum performance (power output) of the thermionic diode was thus defined. ESA

N81-13329*# TAI Corp., Huntsville, Ala.
ANALYSIS OF LOCALIZED FRINGES IN THE HOLOGRAPHIC OPTICAL SCHLIEREN SYSTEM Final Report
Robert L. Kurtz 1980 171 p refs
(Contract NAS8-33509)
(NASA-CR-161619) Avail: NTIS HC A08/MF A01 CSCL 20F

The relation between localization of interference fringes in classical and holographic interferometry is reviewed and an application of holographic interferometry is considered for which the object is a transparent medium with nonhomogeneous refractive index. The technique is based on the analysis of the optical path length change of the object wave as it propagates through a transparent medium. Phase shifts due to variations of the speed of light within the medium give rise to an interference pattern. The resulting interferrogram can be used to determine the physical properties of the medium or transparent object. Such properties include the mass density of fluids, electron densities of plasmas, the temperature of fluids, the chemical species concentration of fluids, and the state of stress in solids. The optical wave used can be either a simple plane or spherical wave, or it may be a complicated spatial wave scattered by a diffusing screen. The mathematical theory on the formation and analysis of localized fringes, the general theoretical concepts used, and a computer code for analysis are included along with the inversion of fringe order data. A.R.H.

N81-13330# California Univ., Livermore. Lawrence Livermore Lab. Military Research Associate Group.
ANALYSIS OF MULTIPASS LASER AMPLIFIER SYSTEMS FOR STORAGE LASER MEDIA
James F. Harvey Jun. 1980 21 p refs
(AD-A090400) Avail: NTIS HC A02/MF A01 CSCL 20/5

Highly efficient short pulse high power lasers have many potential applications, including laser fusion drivers. One technique for achieving high powers in short pulses is to use a storage laser amplifier. A storage laser amplifier uses a laser medium with a long lived upper laser level. The upper laser level can accumulate energy from a pumping source over a relatively long time. This stored energy is then extracted by stimulated emission over a relatively short time. Examples of such storage laser media are Nd:YAG, Nd:Glass, V:MgF2, Tm:Glass, CO2, and Group 6 media (e.g. sulfur and selenium). The single pass amplifier system depicted in (top) is the simplest approach to amplifying a laser light pulse. The laser beam is passed once through the laser medium. The beam is amplified as it extracts energy stored in the medium's upper laser level. The single pass amplifier performance is limited in that it cannot simultaneously provide high energy gain and high efficiency. Under certain conditions these limitations can be overcome by using a multipass system such as the one depicted in the lower part. In this paper a single pass amplifier is investigated first using the Frantz-Nodvik theory of short pulse laser amplification. The multipass system is then treated by sequentially applying the single pass extraction equations for each extraction pass. In order to find the gain coefficient for each extraction, the changes occurring in the laser medium and in the laser beam fluence between extraction passes are determined using a simple three level laser kinetics model. GRA

N81-13331# Army Armament Research and Development Command, Aberdeen Proving Ground, Md.
PRESSURE REGULATION IN A REDUCED PRESSURE CHAMBER USING A CRYOGENIC TEMPERATURE CONTROLLER
Mark A. Dewilde Aug. 1980 20 p
(DA Proj. 1L1-61102-AH-43)
(AD-A091245; AD-E430519; ARBRL-MR-03056) Avail: NTIS HC A02/MF A01 CSCL 13/11

A cryogenic temperature controller, invented at the University of Virginia, is adapted for use as a pressure regulator in a reduced pressure flame studies system. Designed for use in a dynamic flow system, the regulator will hold a pressure within worst limits of 5 mm Hg throughout a flow range of 0.1 lpm to 40 lpm, in a pressure range of 2 to 760 mm. GRA

N81-13332# Defence Research Establishment Valcartier (Quebec).
IMAGE ENHANCEMENT BY SPECTRAL RATIONING
J. F. Boulter Jun. 1980 23 p refs
(AD-A091238; DREV-R-4170/80) Avail: NTIS HC A02/MF A01 CSCL 14/5

In a reflectivity image, contrast produced by differences in surface material is often of more interest than that produced by differences in surface orientation or illumination. The latter factors may be difficult to predict or to allow for in practice. We show that, in certain cases, contrast caused by differences in surface orientation and illumination may be reduced or eliminated by dividing an image obtained in one spectral band by one obtained in a different spectral band. We illustrate this technique by enhancing the images of military vehicles recorded on color film, and by enhancing man-made objects in an aerial multispectral scanner image relative to vegetation. GRA

N81-13333# Los Alamos Scientific Lab., N. Mex.
VALIDATION AND SENSITIVITY OF A SIMULATED PHOTOGRAPH TECHNIQUE FOR VISIBILITY MODELING
Michael Williams, Lo Yin Chan, and Renate Lewis 1980 11 p refs Presented at the Symp. on Plumes and Visibility, Grand Canyon, Ariz., 10-14 Nov. 1980 Prepared in cooperation with the John Muir Inst. for Environmental Studies, Inc., Santa Fe, N. Mex.
(Contract W-7405-eng-36)
(LA-UR-80-2604; CONF-801114-3) Avail: NTIS HC A02/MF A01

The work focused on three areas: comparison of the LASL model results with plumes encountered in the field, comparison of LASL background-atmosphere model results with measured sky intensities, and examination of the variation of model results with changes in the numerical approximations. Telephotometer, NO/sub x/ plume measurements, and aerosol size distribution measurements were made in the plumes of three different coal-fired power plants. Photographs were taken of the plumes, and simulated photographs were prepared by the model. Light intensities calculated by the background rediative transfer model were compared to measured light intensities in a very clean atmosphere and in a moderately hazy atmosphere. The measured intensities were derived from photographic densities. In addition to the field measurements, differences resulting from increased numbers of wavelengths in the color representation were examined. Other changes were also examined in the numerical approximations. The results of these studies are described. DOE

N81-13334# Los Alamos Scientific Lab., N. Mex.
HIGH-VOLTAGE PULSE MONITOR SYSTEM FOR NEUTRINO ELECTRON ELASTIC SCATTERING
Charlie Dalton Aug. 1980 7 p refs
(Contract W-7405-eng-36)
(LA-8505-MS) Avail: NTIS HC A02/MF A01

The Neutrino Electron Elastic Scattering Experiment uses 40 high voltage pulsers and 40 flash chamber detector modules. The proposed microprocessor controlled monitor system to ensure the safe and efficient operation of the high voltage pulsers and flash chambers is described. DOE

N81-13335# Sandia Labs., Albuquerque, N. Mex. High Density Plasma Source Div.
FEASIBILITY STUDY OF A SHADOWGRAPHY PLASMA DIAGNOSTIC USING A HIGH-SPEED FRAMING CAMERA
M. A. Palmer Sep. 1980 13 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-1827) Avail: NTIS HC A02/MF A01

An Imacon 675 electro-optical camera operating as fast as 6 x 10 to the 8th power frames/sec was used to record ten consecutive shadowgrams of transient plasma interactions. The

resolution of the camera system at 6 x 10 to the 8th power frames/sec is 4 line pairs/mm perpendicular to the timesweep direction and 2 line pairs/mm parallel to the timesweep direction. At 5x optical magnification this corresponds to a resolution of 50 micrometers x 100 micrometers in the object plane, with a 2 mm x 1 mm field of view. The probe laser is a 100 mW CW argon-ion laser. This probe laser power is marginal in that it is just above the system recording threshold and is only slightly brighter than the plasma emission. A more intense probe laser would improve system performance considerably and may allow this technique to be a useful plasma diagnostic tool. DOE

N81-13336# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Metallurgy and Materials Science.
EXPERIMENTS IN HIGH VOLTAGE ELECTRON MICROSCOPY Progress Report, 31 Oct. 1979 - Jul. 1980
T. E. Mitchell, L. W. Hobbs, T. Mukai, H. Liu, M. Pascucci, and R. A. Youngerman Jul. 1980 18 p refs
(Contract DE-AS02-76ER-02119)
(COO-2119-23) Avail: NTIS HC A02/MF A01

Radiation effects in alloys and ceramics are reported. A variety of effects of irradiation on phase stability in alloys, including radiation-induced and enhanced phase instability, disordering and secondary defect formation in various alloys, is discussed. In ceramics, the response to irradiation is even more complex due to considerations of stoichiometry and imbalance in the spectrum of primary defects (anions and cations). These responses are categorized in three ways: (1) the formation of stoichiometric defects (loops and voids); (2) decomposition or precipitation of a second phase; and (3) transition from the crystalline to the amorphous state (amorphization or metamictization). DOE

N81-13337# Sandia Labs., Albuquerque, N. Mex.
ION-IMPLANTED PLZT CERAMICS: A NEW HIGH-SENSITIVITY IMAGE STORAGE MEDIUM
P. S. Peercy and C. E. Land 1980 14 p refs Presented at the 1980 IEEE-SID Bien. Display Res. Conf., Cherry Hill, N.J., 21 Oct. 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-1030C; CONF-801060-1) Avail: NTIS HC A02/MF A01

Studies of photoferroelectric (PFE) image storage in H and He ion implanted PLZT (lead lanthanum zirconate titanate) ceramics demonstrate that the photosensitivity of PLZT can be significantly increased by ion implantation in the ceramic surface to be exposed to image light. Implantations of Ar and Ar + Ne into the PLZT surface produce much greater photosensitivity enhancement. Measurements indicate that the photosensitivity enhancement in ion implanted PLZT is controlled by implantation produced disorder which results in marked decreases in dielectric constant and dark conductivity and changes in photoconductivity of the implanted layer. The effects of Ar and Ar + Ne implantation are presented along with a phenomenological model which describes the enhancement in photosensitivity obtained by ion implantation. This model takes into account both light and implantation induced changes in conductivity and gives quantitative agreement with the measured changes in the coercive voltage V(sub c) as a function of near uv light intensity for both unimplanted and implanted PLZT. DOE

N81-13338# Sandia Labs., Albuquerque, N. Mex.
STATS: A UNIQUE HIGH SPEED, MULTIPLE CHANNEL, REAL-TIME DATA ACQUISITION SYSTEM
Frank A. Ross, Larry OConnell, and Ron Trellue 1980 4 p Sponsored by DOE
(SAND-80-1944C; CONF-801027-2; CONF-801121-2) Avail: NTIS HC A02/MF A01

A stand alone test system, called STATS, was developed to acquire and analyze data from as many as 120 analog channels. The STATS is used in testing weapon systems under simulated environments at a laboratory in Texas. Some analog channels are sampled every 10 microseconds but most are digitized every 100 microseconds. It features hardware data compression and a first-in first-out buffer for each channel. It has also provided a way for the test configuration to be controlled by the diskette files which contain the test specifications. The analysis specifications are also predefined in diskette files keyed to the particular test type. The techniques used are applicable when: (1) many channels must be monitored simultaneously; (2) channel activity comes in spurts separated by long quiet periods; and (3) more than a few channels experience nearly simultaneous bursts of activity. DOE

N81-13339# Sandia Labs., Albuquerque, N. Mex.
A MICROBALANCE APPARATUS FOR MEASURING MOISTURE ABSORPTION AND DESORPTION
K. D. Boultinghouse Jun. 1980 17 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-0975) Avail: NTIS HC A02/MF A01

An apparatus for measuring water absorption and desorption and environmental test conditions over a saturated aqueous salt solution is described. The apparatus consists of a vacuum gravimetric microbalance and associated instrumentation. The apparatus can accommodate a specimen size of 2.54 cm x 2.54 cm x 10.16 cm and weight of 100 gm. The balance will respond to mass changes from near vacuum to positive pressure of 2 atmospheres. The maximum operating temperature of the system is 125 C. As water is absorbed or desorbed by the specimen, the mass change and environmental data (temperature, pressure and dew point) are continuously collected in digital form. Desorption of the test specimen is performed under full vacuum; data from both tests can then be manipulated in a variety of ways and plotted. To demonstrate the utility of the apparatus, test procedures and data from the system are presented. Multiple tests measuring moisture diffusion in an epoxy resin casting (Ferro CE-9000) indicate that the system is capable of accurately measuring rates of diffusion as low as 8.18 x 10 to the minus 10th power cu cm/s. R.C.T.

N81-13340# KMS Fusion, Inc., Ann Arbor, Mich.
HOLOGRAPHIC INTERFEROMETRY: A VERSATILE LASER FUSION DIAGNOSTIC
G. E. Busch 1980 5 p Presented at the Topical Meeting on Inertial Confinement Fusion, San Diego, Calif., 26 Feb. 1980
(Contract DE-AC08-78DP-40030)
(KMSF-U-945) Avail: NTIS HC A02/MF A01

Subnanosecond holographic interferometry finds numerous applications in the characterization of a fusion driver and in the probing of subcritical plasma profiles produced by 1.053 micrometer and 0.527 micrometer laser radiation. DOE

N81-13341# Hanford Engineering Development Lab., Richland, Wash.
DUAL GAGING 2200 C JOHNSON NOISE POWER THERMOMETER
C. P. Cannon Jun. 1980 17 p Presented at the NRC Instrumentation Review Group Meeting, Oak Ridge, Tenn., Jul. 1980
(Contract DE-AC14-76FF-02170)
(HEDL-SA-2198) Avail: NTIS HC A02/MF A01

A noise power thermometer for temperature measurements to 2200 C in reactor fuel rods was fabricated and tested for use in the loss of fluid test reactor safety tests. Temperature is determined by measuring the thermal noise spontaneously generated in a sensor coil. Thermoelement wires are used for connecting leads to the sensor coil and thereby provide for simultaneous temperature measurement as a thermocouple. The thermocouple probe is sealed with an alumina ceramic to metal seal and a stainless steel sheathed compensating lead cable transmits the output signal to the measurement instrumentation. DOE

N81-13342# Pennsylvania Univ., Philadelphia.
NEW TYPE OF CHERENKOV IMAGING DETECTOR
Barry Robinson May 1980 9 p refs Presented at Intern. Conf. on Exptn. at LEP, Uppsala, Sweden, 16 Jun. 1980
(Contract DE-AC02-76ER-03071)
(COO-3071-249; CONF-800684-5) Avail: NTIS HC A02/MF A01

An imaging Cherenkov counter is developed to measure the velocities of several secondary particles simultaneously over wide ranges in gamma. This detector, called the ORCID (Optical Readout Cherenkov Imaging Detector) distinguished from other CID's by its readout system, which uses a lens to refocus and reduce a

mirror image onto an image intensifier. The image intensifier is in turn coupled to an optical CCD array. DOE

36 LASERS AND MASERS

Includes parametric amplifiers.

N81-13343 Illinois Univ. at Urbana-Champaign.
AN OPTICALLY PUMPED FREQUENCY STABLE TUNABLE MASER AND INFRARED-MICROWAVE DOUBLE-RESONANCE EXPERIMENTS IN AMMONIA Ph.D. Thesis
Edward George Malk 1980 137 p
Avail: Univ. Microfilms Order No. 8026552

Microwave emission attributed to a linear cascade effect was observed from NH3-14 optically pumped by a CO2 laser. The emission is tunable over the saturated homogeneous linewidth of the ground state sQ(5,4) inversion transition at 22.653 GHz. The circulating power density of the optically pumped emission is 0.54 watts/sq cm at NH3 pressure of 0.91 torr and CO2 R(6) sub 10 laser pulse energy of 60 mJ. The cell design and frequency characteristics are presented as an appendix. Infrared microwave double resonance experiments were performed at higher microwave powers than reported in the literature. Two previously unreported double resonances were observed using a CO2 laser, aQR(2,1) (P(40) sub 9 + 33.05 GHz) and aQR(2,2) (P(40) sub 9 + 34.14 GHz). The cells designed and the data acquisition techniques developed are presented. The linear and nonlinear (i.e., single and multiple photon) spectroscopy of NH3-14 is considered in detail as the subject of an appendix. Tables of energy levels, ground state inversion transitions, and laser-NH3 absorption matches are also included. Dissert. Abstr.

N81-13344 Rochester Univ., N. Y.
A DYNAMIC MODEL OF OPTICALLY PUMPED ENERGY STORAGE LASERS Ph.D. Thesis
John Henry Kelly 1980 200 p
Avail: Univ. Microfilms Order No. 8028913

A complete model of optically pumped energy storage laser media predicts stored energy density and heat deposition as a function of both time and space. The relevant physics for solid state and liquid energy storage media were considered including nonradiative loss mechanisms such as cooperative relaxation and multiphonon relaxation, and radiation loss mechanisms such as spontaneous emission and, for one particular geometry, amplified spontaneous emission. The model was applied to two energy storage media, xenon flashlamp pumped neodymium in glass and resonantly pumped (either xeF or dye) trivalent thulium in glass. For the nonradiative losses in both Nd and Tm systems classical electromagnetic cooperative relaxation theory was used. A concentration squared dependence is predicted and a 3/2 power dependence observed. The model was applied to a large aperture, active mirror configuration Nd:glass amplifier. Comparisons with the measured small signal performance of several active mirrors is shown and agreement is excellent.
Dissert. Abstr.

N81-13345 Colorado State Univ., Fort Collins.
LASER SPECTROSCOPY OF LOW PRESSURE dc HOLLOW CATHODE DISCHARGE PLASMAS Ph.D. Thesis
David Charles Gerstenberger 1980 102 p
Avail: Univ. Microfilms Order No. 8028736

A tunable single frequency CW dye laser was used as a plasma diagnostic tool for low pressure dc hollow cathode discharge plasmas. The narrow spectral character (< 1 MHz) and continuous tunability of this device greatly simplify the analysis of spectroscopic data. Doppler limited and Doppler free spectroscopic data facilitated the measurement of atomic temperatures, the populations of various excited atomic states, and the density of electrons in the hollow cathode discharge. Rare gas and metal atoms were found to be in thermal equilibrium in a Ne-Cu discharge. The variation of temperatures of rare gas atoms with current was consistent with the observed V-I characteristics. The populations of various atomic states were described by simple models including the important collisional and radiative processes. Electron density measurements indicated that the discharge was diffusion dominated under the conditions studied. The experimental results were used to estimate the expected performance of a He-Cu(+) laser. Dissert. Abstr.

N81-13346 Rochester Univ., N. Y.
LENGTH DEPENDENCE OF LASER PHOTON STATISTICS Ph.D. Thesis
Chour-Yih Huang 1980 100 p
Avail: Univ. Microfilms Order No. 8028909

When the cavity length of a laser is increased while the gain and the loss constant are kept constant, the ratio of the spontaneous emission to the induced emission decreases, so that the laser light becomes increasingly coherent. The length dependence of a plane wave single mode laser was examined by using the Scully-Lamb theory (1967). A perturbation approach was also used in multiatom interactions were included in a Gaussian wave single mode lase theory. The Gaussian wave mode was found to modify the length dependence of the photon statistics. The influences of cooperative effects associated with multiatom interactions are discussed. These theoretical predictions are discussed experimentally. In the experiment, instead of keeping the gain and the loss constant as the cavity length is changed, which is difficult to do in practice, the length dependence was examined at various fixed pump parameters. The experimental results are found to be in good agreement with the theory; the modification due to the Gaussian wave mode is verified, although the cooperative effect is too small to be observable for the small He-Ne plasma tube used in the experiment. This effect should be observable in other more powerful lasers.
Dissert. Abstr.

N81-13347# Oklahoma Univ., Norman.
ELECTRON IMPACT OF LASER MEDIA Final Scientific Report, 15 Jun. 1979 - 14 Jun. 1980
David E. Golden 14 Aug. 1980 72 p refs
(Grant AF-AFOSR-2866-75; AF Proj. 2301)
(AD-A091012; AFOSR-80-1000TR) Avail: NTIS HC A04/MF A01 CSCL 20/5

The experimental program is aimed at an understanding of the physics necessary for the design of lasers which are excited by electron impact. Electron impact excitation cross sections, optical branching ratios of the subsequent decays, excited state lifetimes, polarization of radiation, collisional deactivation, and energy transfer rates are measured. Cross sections for the excitation of fine structure levels and alignment and orientation parameters are also measured. GRA

N81-13348# Air Force Academy, Colo. Frank J. Seiler Research Lab.
CHEMICAL GENERATION OF O2(1 DELTA G), 2. Interim Report, 18 Dec. 1978 - 30 Mar. 1979
Lee E. Myers, D. Lengenfelder, C. J. Dymek, and L. P. Davis Aug. 1980 28 p refs
(AF Proj. 2303)
(AD-A090731; FJSRL-TR-80-0018) Avail: NTIS HC A03/MF A01 CSCL 20/5

Production of singlet delta oxygen has been measured with electron spin resonance spectroscopy. A chemical reaction between chlorine and basic hydrogen peroxide was used to produce the excited oxygen. Several chemical and physical parameter variations were studied and analyzed on the basis of the fraction of singlet delta oxygen in the total oxygen product gas. GRA

N81-13349# Rochester Univ., N. Y.
EXPERIMENTS WITH VERY HIGH-POWER LASERS
1979 39 p refs Workshop held at Rochester, N.Y., 29-30 Nov. 1979 Sponsored by DOE
(DOE/ER-10522/1) Avail: NTIS HC A03/MF A01

Experiments in the study of the spectroscopy and cross section measurements of highly ionized species, the study of nuclear convention processes, vacuum-ultraviolet lasers, multiphoton absorption, and the Kapitza-Dirac effect were discussed. Shock waves driven by ultrahigh-power lasers are capable of attaining pressures of the order of 1 to 4 T Pain material targets, providing a means of deriving equation of state data under such extreme conditions. Modifications observed in the structures of materials subjected to high power laser radiation can lead to studies of

damage and phase change processes. Classes of useful experiments in this area are given. Author

N81-13350# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
A KINETIC STUDY OF THE REACTION OF CH3 O2 WITH NO2, VOLUME 1
A. R. Ravishankara, R. L. Eisele, and P. H. Wine 1980 39 p refs
(Contract DOT-FA78WA-4259)
(AD-A091293; FAA-EE-80-38-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 20/5

The technique of pulsed laser photolysis-long path laser absorption is employed to study the kinetics of the reaction CH3O2 - NO2 - N2 yields at K sub 1 CH3O2NO2 - N2 over the temperature range 253-353 K. At all temperatures, k sub 1 is found to monotonically increase with increasing N2 pressure over the range 76-722 torr, indicating that reaction occurs predominantly by addition. The dependence of k sub 1 on N2 pressure shows that the reaction is in the fall-off region between second and third order kinetics. These results are compared with previous results and their atmospheric implications are discussed. GRA

N81-13351# Westinghouse Research and Development Center, Pittsburgh, Pa.
THALLIUM MERCURY LASER DEVELOPMENT Final Report, 1 Feb. 1979 - 31 Jan. 1980
C. S. Liu, D. W. Feldman, and J. L. Pack 17 Apr. 1980 18 p ref
(Contract N00014-78-C-0131)
(AD-A090840; Rept-80-9C-HOTEX-R1) Avail: NTIS HC A02/MF A01 CSCL 20/5

The major effort was to perform definitive gain measurements on discharge-excited T1-Hg laser mixtures and to demonstrate T1Hg laser output at 459 micrometers if the gain measurement indicated that laser tests were warranted. Gain and absorption measurements of the discharge containing high densities of mercury (3 x 10 to the 19th power cm -3) and thallium (6 x 10 to the 16th power cm -3) were undertaken. No transient gain was observed within the T1Hg* excimer band at 459 nm; on the contrary, a strong absorption from Hg_2^* molecules in this region was detected. GRA

N81-13352# Alabama Univ. at Huntsville. School of Science and Engineering.
DEVELOPMENT AND ANALYSIS OF CLOSED CYCLE CIRCULATOR ELEMENTS Final Report, 31 Jul. 1978 - 31 May 1980
Cornelius C. Shih, Gerald R. Karr, and James F. Perkins May 1980 326 p refs
(Contract DAAK40-78-C-0219)
(AD-A091296; AD-E950045; UAH-RR-244; DRSMI/RH-80-9-TR) Avail: NTIS HC A15/MF A01 CSCL 20/5

A series of experiments with various flow rates of laser gas and coolants under several levels of energy inputs has been conducted on the Army Closed Cycle Circulator for pulsed EDL to collect sufficient data for flow calibration and coefficient determination. Verification of the theoretical models depicting the functions of the heat exchangers in maintaining the thermal balance in the flow through the steady and transient states are made through comparison with results of the experimental analysis. GRA

N81-13353# California Univ., Berkeley. Electronics Research Lab.
EFFECTS OF THE CURRENT DISTRIBUTION ON THE CHARACTERISTICS OF THE SEMICONDUCTOR LASER WITH A CHANNELED SUBSTRATE PLANAR STRUCTURE Interim Report
Chung Yih Chen and Shyh Wang Aug. 1980 45 p refs
(Contract F49620-79-C-0178; Grant DAAG29-77-G-0053; AF Proj. 2305)
(AD-A091125; AFOSR-80-1030TR) Avail: NTIS HC A03/MF A01 CSCL 20/5

Effects of the current distribution along the junction plane on the lateral and longitudinal mode behaviors of the semiconductor laser with a channeled-substrate planar (CSP) structure are investigated experimentally and theoretically. A new laser structure of the double-current-confinement CSP type, which has two electrodes for pumping and only one channel for stimulated emission (TEPOSE), was employed for this study. Current distribution profile of this laser can be varied by changing the relative strength of the current in each electrode. Experimental results showed that an asymmetric current profile can degrade the fundamental-lateral mode operation. A theoretical model based on phase-locked two-mode excitation was developed to account for the far-field pattern of a TEPOSE laser with only one electrode excited. It is also found that nonuniform excitation over the lasing mode can lead to multi-longitudinal mode, probably due to nonuniformity in the quasi-Fermi level separation. The present study demonstrates the importance of symmetric and uniform current distribution in designing semiconductor lasers. GRA

N81-13224*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
X-BAND, LOW-NOISE, TRAVELING-WAVE MASER
D. L. Trowbridge *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 126-131 refs (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 20E

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N81-13354 Illinois Univ. at Urbana-Champaign.
LARGE DEFLECTIONS OF HELICAL SPRINGS Ph.D. Thesis
Hubert Lane Morehead 1980 98 p
Avail: Univ. Microfilms Order No. 8026562

The problem analyzed is that of a helical spring subjected to end couples and forces which product large deflections of the spring. These deflections are such that the angle of rotation of one end of the spring centerline with respect to the other end of the spring centerline exceeds the range within which small angle approximations are possible and may be as large as pi radians. The spring is treated as a prismatic bar with known compressive, bending, and shear rigidities. These rigidities are functions of the pitch of the spring and therefore change as the spring is deformed. Furthermore, the spring rigidities assumed different values along the length of the deformed spring as the pitch varies from point to point along the deformed spring centerline. Equations are developed which will predict the deflections of any number of points along the spring centerline. From these, the deformed shape of the spring is determined. The equations developed employ elliptic integrals of the first, second, and third kinds. To facilitate the use of the equations, therefore, a computer program was included in the analysis. Dissert. Abstr.

N81-13355 Florida Univ., Gainesville.
A UNIFIED APPROACH TO THE MASS BALANCING OF ROTATING FLEXIBLE SHAFTS Ph.D. Thesis
Mark Sandor Darlow 1980 325 p
Avail: Univ. Microfilms Order No. 8029051

A new balancing procedure is analytically developed and is referred to as the Unified Balancing Approach. A detailed procedure is outlined for its implementation and test results are reported which verify the effectiveness of the Unified Balancing Approach. These results demonstrate its superiority over modal and influence coefficient balancing, in terms of both efficiency and effectiveness. The Unified Balancing Approach was specifically designed to take into account practical rotor balancing considerations. This is of particular importance since the ultimate test of any rotor balancing method must involve practical applications. Combined with modern microcomputer hardware, the Unified Balancing Approach forms an operation oriented balancing tool which is ideally suited to fill the current gap in flexible rotor balancing, particularly for use in the field. The design of such a portable balancing tool is described in detail. Dissert. Abstr.

N81-13356 Purdue Univ., Lafayette, Ind.
CERMET CUTTING TOOLS, PROPERTIES AND PREDICTION OF PERFORMANCE Ph.D. Thesis
Essam H. Roushdy 1980 209 p
Avail: Univ. Microfilms Order No. 8027331

The progress in machining technology depends, to a great extent, on the knowledge of what happens at the cutting edge of the tool as it is what happens at the tool/workpiece interface that determines the performance of tools, the quality of the machine surface and the machinability of metals. The research led to the following general conclusions: the performance of the CERMET cutting tools is significantly affected by the cutting speed and feed, the tool material material grain size and hardness, the value of the work material unit horsepower, the interaction effect between the tool and the workpiece material. The interaction effect of the tool workpiece is the result of a unique combination of the workpiece and tool material properties. This combination suggests that, through a proper selection procedure of both, the tool performance is optimized. Dissert. Abstr.

N81-13357*# National Aeronautics and Space Administration. *Lewis Research Center, Cleveland, Ohio.*
DESIGN STUDIES OF CONTINUOUSLY VARIABLE TRANSMISSIONS FOR ELECTRIC VEHICLES
Richard J. Parker, Stuart H. Loewenthal, and George K. Fischer 1981 18 p refs Presented at SAE Congr., Detroit, 23-27 Feb. 1981
(Contract EC-77-A-31-1044)
(NASA-TM-81642; E-588; DOE/NASA/1044-12) Avail: NTIS HC A02/MF A01 CSCL 13I

Preliminary design studies were performed on four continuously variable transmission (CVT) concepts for use with a flywheel equipped electric vehicle of 1700 kg gross weight. Requirements of the CVT's were a maximum torque of 450 N-m (330 lb-ft), a maximum output power of 75 kW (100 hp), and a flywheel speed range of 28,000 to 14,000 rpm. Efficiency, size, weight, cost, reliability, maintainability, and controls were evaluated for each of the four concepts which included a steel V-belt type, a flat rubber belt type, a toroidal traction type, and a cone roller traction type. All CVT's exhibited relatively high calculated efficiencies (68 percent to 97 percent) over a broad range of vehicle operating conditions. Estimated weight and size of these transmissions were comparable to or less than equivalent automatic transmission. The design of each concept was carried through the design layout stage. A.R.H.

N81-13358*# National Aeronautics and Space Administration. *Lewis Research Center, Cleveland, Ohio.*
ELASTOHYDRODYNAMIC LUBRICATION OF ELLIPTICAL CONTACTS
Bernard J. Hamrock 1981 13 p refs Proposed for presentation at the 1st Symp. INTERTRIBO '81, Stbske Pleso, Czechoslovakia, 27-29 Apr. 1981
(NASA-TM-81647; E-663) Avail: NTIS HC A02/MF A01 CSCL 11H

The determination of the minimum film thickness within contact is considered for both fully flooded and starved conditions. A fully flooded conjunction is one in which the film thickness is not significantly changed when the amount of lubricant is increased. The fully flooded results presented show the influence of contact geometry on minimum film thickness as expressed by the ellipticity parameter and the dimensionless speed, load, and materials parameters. These results are applied to materials of high elastic modulus (hard EHL), such as metal, and to materials of low eastic modulus (soft EHL), such as rubber. In addition to the film thickness equations that are developed, contour plots of pressure and film thickness are given which show the essential features of elastohydrodynamically lubricated conjunctions. The crescent shaped region of minimum film thickness, with its side lobes in which the separation between the solids is a minimum, clearly emerges in the numerical solutions. In addition to the 3 presented for the fully flooded results, 15 more cases are used for hard EHL contacts and 18 cases are used for soft EHL contacts in a theoretical study of the influence of lubricant starvation on film thickness and pressure. From the starved results for both hard and soft EHL contacts, a simple and important dimensionless inlet boundary distance is specified. This inlet boundary distance defines whether a fully flooded or a starved condition exists in the contact. Contour plots of pressure and film thickness in and around the contact are shown for conditions. A.R.H.

N81-13359*# *Shaker Research Corp., Ballston Lake, N. Y.*
MEASUREMENT OF ROD SEAL LUBRICATION FOR STIRLING ENGINE Final Report, Mar. 1979 - Jun. 1980
Allan I. Krauter Jul. 1980 62 p refs
(Contract DEN-3-22; EC-77-A-31-1040)
(NASA-CR-165157; DOE/NASA/022-2; SRC-80TR-62) Avail: *NTIS HC A04/MF A01 CSCL 11A*

The elastohydrodynamic behavior of sliding elastomeric seals for the Stirling engine, was analyzed using an experimental apparatus to determine the instantaneous oil film thickness throughout the cyclic reciprocating motion. Tests were conducted on two commercial elastomeric seals: a 'T' seal (76 mm O.D. and 3.8 mm between backing rings) and an 'O' ring (76 mm O.D. and 5.3 mm diameter). Testing conditions included seal durometers of 70 and 90, sliding velocities of 0.8, 2.0, and 3.6 m/s, and no pressure gradient across the seal. Both acrylic and aluminum cylinders were used. Measured oil film thickness profiles were compared to results of the elastohydrodynamic analysis. The comparison shows an overall qualitative agreement. Friction and oil leakage measurements were also made at these sliding speeds. The fluid used was a typical synthetic base automotive lubricant. It is concluded that this first time experimental analytical comparison for oil film thickness indicates the need for some improvements in the analytical model and in the experimental technique. A.R.H.

N81-13360# *Coast Guard Research and Development Center,* Groton, Conn.
HAZARDOUS CHEMICAL PUMP TESTS Final Report
Stephen J. Rosenberg and Roger F. Christensen 1 Jul. 1980 43 p refs
(AD-A091052; CGR/DC-4/80; USCG-D-57-80) Avail: NTIS *HC A03/MF A01 CSCL 13/11*

Three hydraulically powered submersible centrifugal pumps, the Framo TK-4, Framo TK-5 and Thune Eureka 150, were tested to document their performance in pumping viscous liquids. The tests were performed using an ADAPTS 40 HP prime mover or a NAVSEA 80 HP prime mover under controlled viscosity (temperature) and discharge pressure to simulate the various hazardous chemicals and long discharge lines expected during the offloading of stricken vessels. All three pumps performed adequately under the test conditions. In particular, the Framo TK-5 can provide a greater discharge flow rate than the Framo TK-4 under the same test conditions. The Framo TK-5 performed well with the ADAPTS prime mover. Both the Framo TK-5 and the Thune-Eureka 150 pumps performed well with the NAVSEA prime mover. The NAVSEA prime mover has the capability to operate two Framo TK-5 pumps simultaneously. The results will be used to help in preparing procurement specifications for a Coast Guard hazardous chemical pumping system. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N81-13361 Purdue Univ., Lafayette, Ind.
A METHOD FOR AUTOMATIC VISUAL INSPECTION AND WIRE BONDING OF INTEGRATED CIRCUITS Ph.D. Thesis
Yao-Yang Hsieh 1980 274 p
Avail: Univ. Microfilms Order No. 8027288

An integrated system for automatic visual inspection and wirebonding of integrated circuits is proposed. The functions of the image segmentation and registration subsystem include image segmentation, gross registration, and the microregistration of mask subpatterns. The input image S is first decomposed into the image W of the IC chip and the background. The gross registration of the IC chip is achieved by locating the mask from microregistered independently. The functions of the visual inspection

subsystem include image transformation, detection and identification of IC defects, and classification. The idea of image transformation is to emphasize relevant information and to suppress irrelevant information. Contextual information is used to remove ambiguity. Each IC defect to be detected by an individual defect detector. Finally, the IC inspection is classified into three classes: (1) accept; (2) reject; and (3) to be reworked. The final packaging subsystem solders an acceptable IC chip to the package substrate, detects the misregistration introduced during the soldering process, and then carries out the wire bonding.
Dissert. Abstr.

N81-13362 *Colorado State Univ., Fort Collins.*
FINITE ELEMENT MODELING OF EDDY CURRENT NON-DESTRUCTIVE TESTING PHENOMENA Ph.D. Thesis
Ramasamy Palanisamy 1980 203 p
Avail: Univ. Microfilms Order No. 8028760

The use of finite element techniques for theoretical modeling eddy current phenomena in two dimensional and axisymmetric geometries, and predicting eddy current probe defect signal trajectories was investigated. The approximating equations describing the interactions between electromagnetic fields and defects at discrete points in the problem region were obtained by minimizing the magnetic energy functional. From the resulting magnetic vector potential values, the impedance of the eddy current probe was calculated. Because of the low intensity of the excitation field generally encountered in the real test situations, a constant initial permeability value was used in developing this numerical model. The finite element predicted results were compared with data obtained from corresponding integral equations and laboratory experiments. Differential eddy current probe signal trajectories observed in the pratical testing of nuclear power plant steam generator tubing were predicted using the axisymmetric finite element model. This theoretical model can predict signals for test situations which are difficult to simulate experimentally and could serve as a 'standard defect signal generator' in training NDT signal analyzers. Dissert. Abstr.

N81-13363# *Army Construction Engineering Research Lab., Champaign, Ill.*
NON-DESTRUCTIVE TESTING FOR FIELD WELDS: REAL-TIME WELD QUALITY MONITOR
Frank Kearney Jun. 1980 14 p refs
(AD-A090409) Avail: NTIS HC A02/MF A01 CSCL 13/8

During the welding process, changes in arc voltage, travel speed, and heat input can occur without the operator's knowledge. These changes can cause defects such as porosity, slag inclusions, incomplete fusion, and undercut in the deposited weld metal. The cost of locating and repairing these defects can be a major portion of construction costs; welding inspection can constitute 25 to 40% of the weld fabrication cost. In addition, weld defects decrease service life of welded joints. Consequently, it is necessary to monitor the welding parameters to detect, identify, and locate possible defects. A weld monitor with real-time output would aid the inspector in designating suspect areas for non-destructing testing after welding. Further, a real-time weld quality monitor could be used to interrupt welding when defects are occurring thus precluding costly rework. To address this need, the US Army Construction Engineering Research Laboratory (CERL) is conducting research to develop a field-portable real-time weld quality monitor (WQM). GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N81-13364 Illinois Univ. at Urbana-Champaign.
MEASUREMENTS OF SURFACE DISPLACEMENTS DURING STRESS WAVE PROPAGATION IN OPAQUE SOLIDS USING PULSED LASER SPECKLE PHOTOGRAPHY Ph.D. Thesis
Michael Arthur Tafralian 1980 66 p
Avail: Univ. Microfilms Order No. 8026604

An experimental method to measure in plane surface displacements in opaque solids was developed. The system consists of combining a pulsed ruby laser source and an optical speckle photography recording scheme. The set-up is capable of measuring surface displacements due to stress waves and propagating cracks in solids. A double exposure recording allows the comparison of object points to be made between two states of displacement. The final specklegram is processed and treated as a diffraction grating to yield both full field or point by point data concerning object displacements. The advantages of such a system include variable sensitivity recordings, noncontacting, ultra fast and it fills the gap between other experimental methods such as moire and holography. Results using Homalite 100 and Lexan are presented. Dissert. Abstr.

N81-13365 Northwestern Univ., Evanston, Ill.
INTERACTION BETWEEN SH WAVES AND A SLIPPING INTERFACE WITH FRICTION Ph.D. Thesis
Eugene Leonard Chez 1980 124 p
Avail: Univ. Microfilms Order No. 8026778

The most significant characteristic of the interaction is the fact that both the mathematical structure of the problem and the ensuing physical consequences are determined by the speed at which the slip zones propagate along the interface. For angles of incidence that avoid total reflection this speed is supersonic with respect to the phase velocities of both materials and the problem can be solved in closed form. The global sliding velocity, the sizes of the slip zones, the displacements at the interface, the rate at which mechanical energy is dissipated, and the partition of energy are displayed in terms of the independent variables involving the amplitude of the incident waves, and the applied pressure and shearing traction. For certain combinations of materials and for angles of incidence that allow total reflection this speed is subsonic with respect to the phase velocity of the faster solid. The formulation in this case leads to singular integral equations of the Cauchy type which must be treated numerically. Dissert. Abstr.

N81-13366 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
VISCOPLASTIC AND CREEP CRACK GROWTH ANALYSIS BY THE FINITE ELEMENT METHOD Ph.D. Thesis
Terry Dean Hinnerichs 1980 198 p
Avail: Univ. Microfilms Order No. 8028556

Creep crack growth in a nickel base alloy at elevated temperatures was analyzed through a hybrid experimental numerical (HEN) procedure. This HEN procedure consisted of simultaneous use of creep crack growth test displacement data from center cracked plate specimens of IN-100 at 1350 F and a theoretical finite element model of the test specimen. A two dimensional (constant strain triangular) finite element program was developed which accounts for both nonlinear viscoplastic material behavior and changing boundary conditions due to crack growth. Three viscoplastic material models: the Malvern Flow Law, the Norton's Creep Law, and the Bodner-Partom Flow Law were incorporated into the program. A method was developed for getting creep crack growth behavior solely from high resolution displacement measurements, in conjunction with a cracked specimen model which utilizes realistic constitutive relationships. Several crack growth rate criteria were investigated, one of which is the stress intensity factor. The K criterion matched fairly well with an extrapolation of published results. Dissert. Abstr.

N81-13367 Northwestern Univ., Evanston, Ill.
THE SURFACE SINGULARITY OF CRACKS Ph.D. Thesis
T. Estenssoro 1980 161 p
Avail: Univ. Microfilms Order No. 8026801

The three dimensional singular stress field near the terminal point O of the crack front edge at the surface of an elastic body is investigated. The variational principle governing the displacement distribution on a unit sphere about point O is derived from the differential equations of equilibrium, and more directly, from the potential energy. It is proved that the variational principle as well as the matrix must be nonsymmetric, which implies that complex eigenvalues are possible. Several numerical and analytical solutions are compared and agree closely with the present work. By energy flux arguments it is found that the

front edge of a propagating crack must terminate at the surface obliquely at a certain angle, whose dependence upon the inclination of a crack plane is also solved. Some results are presented for notches and for cracks that interect a two material interface. Dissert. Abstr.

N81-13368 Toledo Univ., Ohio.
A SEMI-THEORETICAL AND EXPERIMENTAL APPROACH FOR THE DETERMINATION OF THE STRESS INTENSITY FACTORS OF VARIOUS CRACK GEOMETRY AND LOADING CONDITIONS Ph.D. Thesis
Bahram Farahmand 1980 128 p
Avail: Univ. Microfilms Order No. 8028481

First, plates with single and double edge cracks subjected to tension and pure bending were investigated and then the method was utilized for the investigation of the more complicated crack arrangements. Equal parallel edge cracks and equal parallel and symmetric edge cracks, the variation of the length of the cracks and crack spacings on the stress intensity factors are discussed. Also, for unequal parallel edge cracks and unequal parallel and symmetric edge cracks, the crack closure phenomenon and its occurrence relative to the length of the cracks and crack spacings are studied. The optical method that is implanted in this work is called optical shadow method or the method of caustic. According to this method, the incident monochromatic collimated beam of a light source (He-Ne Laser), is impinged on the surface of a transparent cracks specimen which is under a loading condition. Due to the change of the geometry of the surface and the refractive index at the vicinity of the crack tip the beam deviates and, as a result, a transmitted and reflected caustic are formed which then can be observed on the screens. Dissert. Abstr.

N81-13369 Northwestern Univ., Evanston, Ill.
FUNDAMENTAL STUDIES OF FATIGUE CRACK PROPAGATION IN METALS Ph.D. Thesis
Peter Kaehuei Liaw 1980 211 p
Avail: Univ. Microfilms Order No. 8026855

The correlation between the unit area of fatigue work, U, and the rate of fatigue crack propagation was extended to low strength metals, 99.99 Al, 1100 Al alloy and annealed 0.05 w/o C steel, and to the low temperature, 77 K. The additional data allow a better correlation with microstructure. Using foil strain gages, U was measured at delta K = 8 NM/cu m/2 on the identical annealed 0.05 w/o C steel used in an electron channeling study. Extrapolation of strain gage data gave 2.0 x 10 to the 6th power J/sq m for the crack tip compared to 1.7 x 10 to the 6th power =/sq m by electron channeling. A closed loop servo-controlled electrohydraulic fatigue machine was constructed for fatigue crack propagation and strain controlled fatigue studies at 77 K. A large decrease in the fatigue crack propagation rate in 99.99 + Al and 1100 Al alloy on cooling from room temperature to 77 K is due to large increases in both th 2 percent offset cyclic yield stress and U. These increases correlate with the dislocation structures after cyclic deformation. Cyclic hardening occurs for annealed 99.99 + Al at 298 and 77 K. However, cold rolled 99.99 + Al cyclically softens at room temperature and cyclically hardens at liquid nitrogen temperature. Dissert. Abstr.

N81-13370 California Inst. of Tech., Bishop.
THE EQUILIBRIUM FIELD NEAR THE TIP OF A CRACK FOR FINITE PLANE STRAIN OF INCOMPRESSIBLE ELEASTIC MATERIALS Ph.D. Thesis
Rodney Alan Stephenson 1981 70 p
Avail: Univ. Microfilms Order No. 8028436

Deformations and stresses in a slab of all-around infinite extent containing a traction-free plane crack, are examined under conditions of plane strain. The analysis is carried out within the framework of the fully nonlinear equilibrium theory of homogeneous and isotropic incompressible elastic solids. For a fairly wide class of such materials and general loading conditions at infinity, asymptotic estimates appropriate to the various field quantities near the crack-tips are deduced. For a subclass of the materials considered, these results--in contrast to the analogous predictions of the linearized theory--lead to the conclusion that the crack opens up in a neighborhood of its tips even if the applied loading is antisymmetric about the plane of the crack. It is shown further that the non-linear global crack problem corresponding to such a loading in general cannot admit a antisymmetric solution. Dissert. Abstr.

N81-13371 George Mason Univ., Fairfax, Va.
AN ANALYTICAL AND EXPERIMENTAL STUDY OF THE PLATE TEARING MODE OF FRACTURE Ph.D. Thesis
Natarajan Subramonian 1980 141 p
Avail: Univ. Microfilms Order No. 8024299

Nondimensionalized stress intensity factors for practical plate tearing mode specimens are evaluated using Kirchoff bending elements and also the new approach which needs only an equivalent plane stress analysis. Wide differences are noted between the results provided by both these approaches for different plate geometries. A photoelastic study was conducted to evaluate the relative merits of the Kirchoff bending analysis and the proposed approach, which indicates that the experimental results for stress intensity factors are closer to the finite element results obtained using the proposed technique. Information on the development of a loading system for studying the plate tearing mode of fracture in pilot specimens is provided and results from practical observations of plate tearing mode failure in several materials are discussed. Theoretical expressions for isochromatics, plastic zone profiles and the G - K relationship for the plate tearing mode are also derived for ready reference. Dissert. Abstr.

N81-13372 Northwestern Univ., Evanston, Ill.
THREE-DIMENSIONAL DIFFRACTION BY CRACKS IN ELASTIC SOLIDS Ph.D. Thesis
Harry McMaken 1980 184 p
Avail: Univ. Microfilms Order No. 8026870

Two theories that describe the diffraction of mechanical disturbances by planar cracks within the context of three dimensional linearized elastodynamics are developed. The first is the elastodynamic extension of Keller's geometrical theory of diffraction. A modification is presented, which removes the singularities at the boundaries of the zones of the reflected and incident waves. This modification is the elastodynamic equivalent of the uniform symptotic theory of diffraction developed by Lewis and Boersma. The second is the uniform theory of diffraction. This is particularly useful for regions in which the geometrical theory of diffraction predicts caustic surfaces. First, the discontinuity in the surface displacement is computed. Secondly, this displacement, which is also referred to as the crack opening displacement, is integrated with the corresponding Green's function to produce the scattered field. Results are presented for diffraction by slits and elliptical cracks. It is shown that remarkable agreement is obtained when the wavelength is about the same size as the dimensions of the crack. Dissert. Abstr.

N81-13373*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
A NEW LOOK AT NUMERICAL ANALYSES OF FREE-EDGE STRESSES IN COMPOSITE LAMINATES
I. S. Raju, J. D. Whitcomb, and J. G. Goree (Clemson Univ.) Dec. 1980 37 p refs
(NASA-TP-1751; L-13777) Avail: NTIS HC A03/MF A01 CSCL 20K

The edge stress problem for a + or - 45 deg graphite/epoxy laminate was examined. The reliability of the displacement formulated finite element method in analyzing the edge stress problem was investigated. Analyses of two well known elasticity problems, one involving a stress discontinuity and one a singularity, showed that the finite element analysis yields accurate stress distributions everywhere except in two elements closest to the stress discontinuity of singularity. Stress distributions for a + or - 45 deg laminate showed the same behavior near the singularity found in the well known problems with exact solutions. The displacement formulated finite element method appears to be a highly accurate technique for calculating interlaminar stress in composite laminates. The disagreement among the numerical methods was attributed to the unsymmetric stress tensor at the singularity. R.C.T.

N81-13374# Illinois Univ., Urbana. Materials Engineering Research Lab.
A NONARBITRARY FATIGUE CRACK SIZE CONCEPT TO PREDICT TOTAL FATIGUE LIVES Final Report, Feb.

1977 - Jul. 1979
Peter Kurath, D. F. Socie, and JoDean Morrow Wright-Patterson AFB, Ohio AFFDL Dec. 1979 62 p refs
(Grant AF-AFOSR-3195-77; AF Proj. 2307)
(AD-A090596; AFFDL-TR-79-3144) Avail: NTIS HC A04/MF A01 CSCL 20/11

A method combining strain cycle fatigue and fracture mechanics concepts to predict a nonarbitrary crack initiation size, ai, is presented. The nonarbitrary crack size is used as a demarcation between fatigue crack initiation and propagation methods of analysis. Geometry, mean stress, and stress range all influence the value of ai. Five different geometries were analyzed and tested at various load levels and two load ratios. Constant amplitude loading and initial incremental overload are considered. Specimens of an aluminum alloy, Al 7075-T651, were tested in the as-machined condition. Correlations between the analytical life predictions and experimental values of life fell within a factor of two in most cases. GRA

N81-13375# Naval Surface Weapons Center, White Oak, Md. Research and Technology Dept.
CONSTITUTIVE MODEL FOR RAPIDLY DAMAGED STRUCTURAL MATERIALS. 2: FINITE ELEMENT FORMULATION Final Report, Jan. 1978 - Jun. 1980
David W. Nicholson 25 Jul. 1980 24 p
(AD-A090323; NSWC/TR-80-249-2) Avail: NTIS HC A02/MF A01 CSCL 11/6

A constitutive model was recently proposed to describe flow and damage in rapidly loaded structural materials. Its finite element implementation is given in the present work, with numerical results to be reported in a subsequent work. One important feature is that the finite element formulation is 'consistent' in that the damage and flow strains are approximated in the same way as the corresponding parts of the total strain. A second important feature is that certain interelement continuity conditions are imposed in the flow and damage strains. A system of ordinary differential equations in time is obtained for the nodal displacement, flow and damage parameters. GRA

N81-13376# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
A NOTE ON THE ENERGY RELEASE RATE IN QUASI-STATIC ELASTIC CRACK PROPAGATION
James K. Knowles Aug. 1980 26 p refs
(Contract N00014-75-C-0196)
(AD-A091315; TR-46) Avail: NTIS HC A03/MF A01 CSCL 20/11

This paper considers analytical issues associated with the notion of the energy release rate in quasi-static elastic crack propagation. When a crack in a deformed elastic solid lengthens, the new free surface created requires energy for its formation. If the crack propagation process is slow enough to be treated as a quasi-static, continuum mechanical models permit the calculation of the rate at which energy is made available for the generation of new free surface in terms of the solution of the governing equilibrium problem corresponding to the deformation of the cracked solid under given loads. GRA

N81-13377# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
ON SINGULAR PROBLEMS IN LINEARIZED AND FINITE ELASTOSTATICS
Eli Sternberg Aug. 1980 34 p refs Presented at the 15th Intern. Congr. of Theoret. and Appl. Mech., Toronto, Aug. 1980
(Contract N00014-75-C-0196)
(AD-A091298; TR-45) Avail: NTIS HC A03/MF A01 CSCL 20/11

The predictions of linear elasticity theory for various basic types of singular equilibrium problems are illustrated and issues associated with such solutions are discussed. Attention is then turned to recent studies concerning the implications of finite elastostatics for certain singular problems, including some that have no counterpart in the linearized theory. GRA

N81-13378# Naval Ship Research and Development Center, Annapolis, Md. Dept. of Propulsion and Auxiliary Systems.
COMPRESSIONAL DAMPING IN THREE-LAYER BEAMS INCORPORATING NEARLY INCOMPRESSIBLE VISCOELASTIC CORES
Bruce Edward Douglas Oct. 1980 25 p refs
(AD-A091284; DTNSRDC/PAS-80/26) Avail: NTIS HC A02/MF A01 CSCL 20/11

The transverse free mechanical impedance response of an elastic-viscoelastic-elastic beam incorporating the compressional damping mechanism is considered. The work of Douglas and Yang is extended to include shear deformation and rotary inertia in the elastic layers. The effects of nearly incompressible viscoelastic damping cores on the compressional frequency, and hence on the spectral range of damping effectiveness for the composite, is also discussed. Results of the analysis are shown to compare favorably with experimental results for a damped three-layer beam which was optimized for compressional damping and in which the influence of the shear damping mechanism was intentionally minimized. GRA

N81-13379# Delaware Univ., Newark. Applied Mathematics Inst.
SHOCK MODELS WITH PHASE TYPE SURVIVAL AND SHOCK RESISTANCE Interim Report
Marcel F. Neuts and Manish C. Bhattacharjee Aug. 1980 14 p refs Prepared in Cooperation with Indian Inst. of Management, Calcutta
(Grants AF-AFOSR-3236-77; NSF ENG-77-08351)
(AD-A091038; TR-61B; AFOSR-80-0990TR) Avail: NTIS HC A02/MF A01 CSCL 20/1

New closure theorems for shock models in reliability theory are presented. If the number of shocks to failure and the times between the arrivals of shocks have probability distributions of phase type, then so has the time to failure. PH distributions are highly versatile and may be used to model many qualitative features of practical interest. They are also well-suited for algorithmic implementation. The computational aspects of our results are discussed in some detail. GRA

N81-13380# Materials Research Labs., Ascot Vale (Australia).
DATA CONTROLLER SYSTEM FOR FATIGUE CRACK MONITORING USING A POTENTIAL DROP TECHNIQUE
Barry J. Baxter Sep. 1979 24 p refs
(AD-A090953; MRL-TN-429) Avail: NTIS HC A02/MF A01 CSCL 20/11

This report describes the design of a control unit to interface with (1) a digital voltmeter calibrated to respond to fatigue crack growth, (2) load and cycle data from a servo hydraulic system, and (3) a desk calculator. The calculator is programmed to determine crack length, crack growth rate and stress intensity factors. Pre-set limits on the load and number of cycles permits termination of the test when the levels have been exceeded. Appropriate power supplies for the units have also been designed and are described. GRA

N81-13381# Foster Wheeler Corp., Livingston, N.J.
APPLICATIONS OF ONE DIMENSIONAL MODELS IN SIMPLIFIED INELASTIC ANALYSES
S. A. Kamal, J. M. Chern, and D. H. Pai 1980 39 p refs Presented at the ASME Century 2 Emerging Technol. Conf., San Francisco, 10 Aug. 1980
(Contract W-7405-eng-26)
(CONF-800804-22) Avail: NTIS HC A03/MF A01

An approximate inelastic analysis based on geometric simplification with emphasis on its applicability, modeling, and the method of defining the loading conditions is presented. Two problems are investigated: a one dimensional axisymmetric model of generalized plane strain thick walled cylinder is applied to the primary sodium inlet nozzle of the Clinch River breeder reactor intermediate heat exchanger, and a finite cylindrical shell is used to simulate the branch shell forging (Y) junction. The results are then compared with the available detailed inelastic analyses under cyclic loading conditions in terms of creep and fatigue damages and inelastic ratchetting strains per the ASME Code Case N-47 requirements. In both problems, the one dimensional simulation is able to trace the detailed stress-strain response. The quantitative comparison is good for the nozzle, but less satisfactory for the Y junction. Refinements are suggested to further improve the simulation. DOE

N81-13382# Sandia Labs., Albuquerque, N. Mex.
DEPENDENCE OF FRACTURE TOUGHNESS OF MOLYBDENUM LASER WELDS ON PROCESSING PARAMETERS AND IN-SITU OXYGEN GETTERING
L. E. Pope and J. L. Jellison 1980 19 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-1905C; CONF-801132-1) Avail: NTIS HC A02/MF A01

Fracture toughness properties were determined for laser welds in different grades of molybdenum. The fracture toughness of welds in sintered molybdenum was consistently less than the fracture toughness of welds in vacuum arc remelted molybdenum. These differences cannot be attributed to oxygen content, since the oxygen level was nominally the same for all grades of molybdenum examined. Alloy additions of titanium by means of physically deposited coatings significantly improved the fracture toughness of welds in sintered molybdenum, whereas titanium additions to welds in vacuum arc remelted molybdenum decreased the fracture toughness slightly. Pulsed laser welds exhibited fine columnar structures, and, in the case of sintered molybdenum, superior fracture toughness when compared with continuous wave laser welds. DOE

N81-13383# Sandia Labs., Albuquerque, N. Mex. Parachute Systems Div.
TENSILE TESTING OF NYLON AND KEVLAR PARACHUTE MATERIALS UNDER FEDERAL SPECIFIED TEMPERATURE AND RELATIVE HUMIDITY CONDITIONS
Wilson T. Botner 1980 20 p refs
(SAND-80-1806A) Avail: NTIS HC A02/MF A01

A 10 ft x 12 ft temperature and relative humidity controlled room for tensile testing of parachute materials is described. Kevlar 29 and nylon parachute materials were tensile tested for break strength at Federal specified temperature and relative humidity conditions of 70 F for + or - 2 F and 60% for + or - 2% R.H. Results indicate there is a negligible change in break strength of test samples soaked in the controlled environment vs. samples soaked in ambient conditions. DOE

N81-13384 Pittsburgh Univ., Pa.
MECHANICAL VIBRATIONS IN BEAMS AND PLATES OF THERMOHEOLOGICALLY SIMPLE VISCOELASTIC MATERIALS Ph.D. Thesis
Nagesh Ramamoorthy Basavanhally 1980 155 p
Avail: Univ. Microfilms Order No. 8028013

The problem of vibration of viscoelastic beams and plates subjected to a known transient temperature distribution and simply supported boundary conditions was solved using a Williams type modal expansion technique. The viscoelastic property ascribed is linear but otherwise general and its temperature dependence follows the thermoheologically simple law. The internal damping considered is proportional to the velocity of motion. The numerical data are measured for epoxy resins and taken from published viscoelastic properties for float glass. The measured log decrement values for epoxy resin is shown to depend on the frequency of vibration. The damped and undamped vibration response is presented for various size beams and plates, and for various initial temperature and temperature differential. The experimentally measured free vibration response of epoxy resin beams at different but constant temperature is compared with the theoretically developed model. The results for the degenerate case were checked against the existing solutions. Dissert. Abstr.

N81-13385 Illinois Univ. at Chicago Circle, Chicago.
ELASTIC AND ELASTIC PLASTIC ANALYSIS FOR PLATES BY THE HYBRID STRESS FINITE ELEMENT METHOD Ph.D. Thesis
Nasir Iqbal Munir 1980 161 p
Avail: Univ. Microfilms Order No. 8028585

Hybrid stress elements with linear, quadratic and cubic C deg continuous serendipity displacement fields in the element interior are formulated and applied to the analysis of elastic plate bending problems. Transverse shear deformation effects are accounted for irrespective of their magnitude. These elements are shown to be superior in all respects to comparable assumed displacement elements employing reduced or selective reduced integration concepts. Elastic plastic plate bending is also examined. Alternate hybrid stress functionals are considered, both utilizing the initial stress procedure for material nonlinear analysis. The two functionals differ in the stress increment assumed to satisfy equilibrium; in functional 1, it is the (approximate) actual stress increment, whereas in functional 2 it is the elastic stress increment. Extensive numerical studies are performed using the 4 node hybrid stress linear displacement plate element for an elastic plastic beam problem for which an analytic solution is available. Dissert. Abstr.

N81-13386 Northwestern Univ., Evanston, Ill.
CRACK CLOSURE AND CRACK PROPAGATION RATES IN 7050 ALUMINUM Ph.D. Thesis
Dershin Gan 1980 145 p
Avail: Univ. Microfilms Order No. 8026805

Small foil strain gages were glued near to the crack plane to measure the crack closure stress by the change in the slopes of the local strain nominal stress curves recorded by a x-y recorder. This method was shown to have adequate sensitivity and accuracy. The slopes of the local strain nominal stress curves above the crack closure stress showed good agreement with theoretical predictions. The strain gage method was further justified by direct optical observation of crack closure. Dissert. Abstr.

42 GEOSCIENCES (GENERAL)

N81-13387*# National Aeronautics and Space Administration, Washington, D. C.
HEAT BALANCE OF THE EARTH
M. I. Budyko, T. G. Berlyand, N. A. Yefimova, L. I. Zubenok, and L. A. Strokina Apr. 1980 55 p refs Transl. into ENGLISH of the mono. "Teplovoy Balans Zemli" Leningrad, Gidrometeoizdat, 1978 41 p Original language document announced as A78-46579 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75826) Avail: NTIS HC A04/MF A01 CSCL 08E

Results of improved calculations of the heat balance components of Earth's surface are reported for yearly average conditions. The technique used to determine the heat-balance components from land- and sea-based actinometric observations as well as from satellite data on the radiation balance of the Earth-atmosphere system is described, with special attention given to short-wavelength solar radiation on the continents, effective radiation from the land surface, the radiation balance of the ocean surface, heat expended by both evaporation from the ocean surface, and turbulent heat transfer between the ocean surface and the atmosphere. World maps of heat-balance components show yearly average values of total radiation, radiation balance, heat expended by evaporation, the turbulent heat flow between Earth's surface and atmosphere, and heat transfer between the ocean surface and underlying waters. The global surface heat balance is estimated along with global values of the various components and the heat-balance components for different latitude zones. Author

N81-13388# European Space Agency, Paris (France).
SATELLITE REMOTE SENSING APPLICATIONS IN AGROCLIMATOLOGY AND AGROMETEOROLOGY [TELEDETECTION PAR SATELLITE APPLICATIONS EN AGROCLIMATOLOGIE ET AGROMETEOROLOGIE]
Apr. 1980 141 p refs Partly in FRENCH and ENGLISH Presented at ESA/UN Food and Agr. Organ./WMO Conf., Rome, 1-12 Oct. 1979
(ESA-SP-1022) Avail: NTIS HC A07/MF A01

The applications of several satellite observation systems to crop identification, crop field evaluation, soil water balance and Earth resources evaluation are described. Other methods using agrometeorological data, and some observed methodological difficulties are discussed. For individual titles, see N81-13389 through N81-13400.

N81-13389# Food and Agriculture Organization of the United Nations, Rome (Italy).

REVIEW OF AGROMETEOROLOGY [APERCU SUR LA METEOROLOGIE AGRICOLE] c47
Michel Frere *In* ESA Satellite Remote Sensing Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 1-4 In FRENCH (For primary document see N81-13388 04-42)
Avail: NTIS HC A07/MF A01

Agrometeorology is defined and some strategic and tactical problems discussed. The time scale for agrometeorology, the utilization of agrometeorology in long range planning and the operational use of agrometeorology are discussed. It is recommended that agrometeorology be seen as a cooperative effort rather than as a new technique. Author (ESA)

N81-13390# Food and Agriculture Organization of the United Nations, Rome (Italy). Centre de Teledetection.
GENERAL VIEW OF REMOTE SENSING APPLICATIONS IN AGROCLIMATOLOGY AND AGROMETEOROLOGY [VUE GENERALE DE L'EMPLOI DE LA TELEDETECTION DANS L'AGROCLIMATOLOGIE ET L'AGROMETEOROLOGIE] c43
John A. Howard *In* ESA Satellite Remote Sensing Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 5-9 In FRENCH (For primary document see N81-13388 04-42)
Avail: NTIS HC A07/MF A01

A summary of remote sensing history is presented. The present situation and trends are discussed, with a detailed examination of satellite remote sensing programs such as LANDSAT C, LANDSAT D, SPOT, Soyuz-Salyut, SEASAT, TIROS-N, NOAA-6 and GOES. The meteorological parameters of interest in remote sensing are listed. Author (ESA)

N81-13391# Food and Agriculture Organization of the United Nations, Rome (Italy).
THE FOOD AND AGRICULTURE ORGANIZATION (FAO) OF THE UN PROJECT RELATED TO AGROECOLOGICAL ZONES [LE PROJET RELATIF AUX ZONES AGROECOLOGIQUES] c84
Michel Frere *In* ESA Satellite Remote Sensing Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 11-13 refs In FRENCH (For primary document see N81-13388 04-42)
Avail: NTIS HC A07/MF A01

A methodology based on climatic pedologic data is described in which plant physiology is used to characterize the available resources in underdeveloped countries in order to increase the agricultural production. An application to Africa, in which 11 crops were considered, is discussed. Author (ESA)

N81-13392# Institut National de la Recherche Agronomique, Paris (France).
THE APPLICATIONS OF REMOTE SENSING TO AGRICULTURE [APPLICATIONS DE LA TELEDETECTION A L'AGRICULTURE] c43
C. C. Goillot *In* ESA Satellite Remote Sensing Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 17-26 refs In FRENCH (For primary document see N81-13388 04-42)
Avail: NTIS HC A07/MF A01

The principles of soil surface characterization by remote sensing are reviewed and its applications to agriculture discussed. The differences in reflectance presented by soil surface and crop types are shown as a function of radiation wavelength, and the techniques used are described, including IR photography and multiband scanning. Applications to different disciplines such as cartography, soil science, crop inventory, crop growth, and crop disease are examined. Author (ESA)

N81-13393# Institut National de la Recherche Agronomique, Avignon (France). Station de Bioclimatologie.
APPLICATIONS OF REMOTE SENSING IN THE INFRARED TO THE DETERMINATION OF THE EVAPORATION AND THE HUMIDITY OF SOIL [APPLICATION DE LA TELEDETECTION DANS L'INFRAROUGE THERMIQUE A LA DETERMINATION DE L'EVAPORATION ET DE L'HUMIDITE DU SOL] c43
B. Seguin *In* ESA Satellite Remote Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 27-37 refs In FRENCH (For primary document see N81-13388 04-42)
Avail: NTIS HC A07/MF A01

The theoretical basis of remote sensing of soil humidity is discussed, including the surface energy balance, the analysis of microclimate in the proximity of the soil, and the determination of the surface temperature. Practical methods for the application of infrared thermography to the estimation of evaporation are examined and the conclusion is drawn that the technique is already pre-operational and that the satellites equipped with IR sensors (NOAA, TIROS N, HCMM, LANDSAT D) should be operational in a few years. Author (ESA)

N81-13394# European Space Operations Center, Darmstadt (West Germany).
THE METEOSAT SYSTEM AND ITS SERVICES [LE SYSTEME METEOSAT ET SES PRODUITS] c47
M. Fea and P. Louis (European Space Technology Center, Toulouse) *In* ESA Satellite Remote Sensing Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 39-52 In FRENCH (For primary document see N81-13388 04-42)
Avail: NTIS HC A07/MF A01

The Meteosat satellite system, its mission, and results obtained are described. Participation in the World Weather Watch program and the Global Atmospheric Research Program is mentioned. The image processing system, the extraction of meteorological data, and the data acquisition system are detailed. Several applications in addition to those of a meteorological character are mentioned. Author (ESA)

N81-13395# European Space Agency, Paris (France). Dept. des Applications Futures.
THE EUROPEAN REMOTE SENSING PROGRAM [LE PROGRAMME EUROPEEN DE TELEDETECTION] c43
G. Duchossois *In its* Satellite Remote Sensing Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 53-63 refs In FRENCH (For primary document see N81-13388 04-42)
Avail: NTIS HC A07/MF A01

A summary of the European remote sensing program as defined by ESA is presented. The European regional objectives, Earth resources applications and development aid programs are summarized. The Earthnet program and Spacelab experiments are discussed. The future European satellite systems mission objectives and measurement requirements are examined. Author (ESA)

N81-13396# Direction de la Meteorologie Nationale, Paris (France).
AGROMETEOROLOGICAL METHODS [METHODES AGROMETEOROLOGIQUES] c47
N. Gerbier and P. Brochet *In* ESA Satellite Remote Sensing Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 65-70 In FRENCH (For primary document see N81-13388 04-42)
Avail: NTIS HC A07/MF A01

The scope and objectives of agrometeorology in relation to regional agricultural development are discussed. Long range planning, agricultural production techniques, sanitary protection, water resources management, and land use are considered. The influence of climatic factors at several time scales and the economic impact of agrometeorological data are pointed out. Author (ESA)

N81-13397# World Meteorological Organization, Geneva (Switzerland).
DYNAMIC CLIMATOLOGY [CLIMATOLOGIE DYNAMIQUE] c47
H. Germain *In* ESA Satellite Remote Sensing Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 71-85 refs In FRENCH (For primary document see N81-13388 04-42)
Avail: NTIS HC A07/MF A01

The definition, objectives and methodology of dynamic climatology are reviewed. Climate variations are related to the Earth's energy budget and energy transfer mechanisms such as Hadley cells are described. Climatic fluctuations are analyzed taking as examples the Sahel drought, the NE Brazilian drought, and the forecasting of winter season trends in the United States. Author (ESA)

N81-13398# Centre National d'Etudes Spatiales, Toulouse (France).
RADIOMETRIC PROBLEMS IN AGRICULTURAL REMOTE SENSING [PROBLEMES RADIOMETRIQUES EN TELEDETECTION AGRICOLE] c43

G. Saint *In* ESA Satellite Remote Sensing Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 87-99 In FRENCH (For primary document see N81-13388 04-42)
Avail: NTIS HC A07/MF A01

A model describing the directional reflectance of a vegetative canopy is discussed, exposing the problems related to the characterization of different crops. The utilization of the 1976 LANDSAT images for the study of the agriculture in the Landes region is described in detail. Different crops and varieties could be identified and a good correlation with yield of corn crops could be established. Suggestions for developmental work are given. Author (ESA)

N81-13399# Centre National d'Etudes Spatiales, Toulouse (France).
SPOT: PROBE SYSTEM FOR EARTH OBSERVATION [SPOT: SYSTEME PROBATOIRE A'OBSERVATION DE LA TERRE] c43
M. Cazenave *In* ESA Satellite Remote Sensing Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 101-103 In FRENCH (For primary document see N81-13388 04-42)
Avail: NTIS HC A07/MF A01

The characteristics of the SPOT missions are described. The objectives include crop inventories, agricultural resources, crop identification, catastrophe evaluation, spontaneous vegetation studies, and urbanization effects. The characteristics of the high resolution visible radiation radiometer are detailed. The first SPOT mission is described, including orbital characteristics and the access frequency for a given region. Author (ESA)

N81-13400# Food and Agriculture Organization of the United Nations, Rome (Italy).
CROP SURVEILLANCE BASED ON AGROMETEOROLOGICAL DATA [SURVEILLANCE DES CULTURES BASEE SUR DES INFORMATIONS AGROMETEOROLOGIQUES] c43
G. F. Popov *In* ESA Satellite Remote Sensing Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 105-113 In FRENCH (For primary document see N81-13388 04-42)
Avail: NTIS HC A07/MF A01

The principles of a method for crop surveillance and crop forecasting based upon agrometeorological data in use by 15 countries, are explained. Cumulative water balances are determined in successive 10 day periods for each crop and several parameters are deduced from this basic information. The results show a direct relationship between the calculated index and the crop yield. The experience obtained in Africa by the Food and Agricultural Organization using this method is described.
Author (ESA)

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N81-13401 Oregon State Univ., Corvallis.
AN INVESTIGATION INTO MODELING SNOW COVER ELEMENTS AT CRATER LAKE NATIONAL PARK AND SURROUNDING ENVIRONS AS AN IMPROVED GROUND TRUTH METHOD FOR SATELLITE SNOW OBSERVATIONS Ph.D. Thesis
William L. Hamilton 1980 119 p
Avail: Univ. Microfilms Order No. 8027840

A mountain snow cover model capable of generating snow cover data at a scale useful as ground truth for operational satellite snow cover observations was developed to aid in streamflow forecasts for hydroelectric and irrigation reservoirs in the Pacific Northwest. Both the physiography (topography and vegetation) and snow climate of the study area were analyzed. In order to take into account the effects of the dynamic snow climate and physiography upon snow cover conditions, multiple regression analysis was used. Snow depth, snow water equivalent values, and the physiographic elements of slope, aspect, elevation, percentage of forest canopy cover, and regional aspect were recorded for each snow core site. The physiographic elements were regressed against the snow core data to produce snow model equations. The model has a combined spatial, annual, and long term resolution. Current studies are being conducted to couple dynamic snow meteorology and LANDSAT digital data to the model to increase its accuracy and reduce its dependency on snow core data. Also, output of the model can be used for studies on snow cover effect upon wildlife movement and survival and the determination of source regions of relative runoff from snow melt. Dissert. Abstr.

N81-13402*# Centro Studi ed Applicazioni in Tecnologie Avanzate, Bari (Italy).
SCALE EFFECTS: HCMM DATA SIMULATION. USAGE OF FILTERING TECHNIQUES FOR SCALING-UP SIMULATIONS
V. DiGennaro, Principal Investigator [1980] 63 p refs Sponsored by NASA Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; nondomestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(E81-10041; NASA-CR-163751) Avail: NTIS HC A04/MF A01 CSCL 08B

Image reduction used to simulate increase in altitude of an acquisition platform is equivalent to data smoothing, and can be achieved either by neighborhood averaging or by filtering techniques. The averaging approach is limited for accurate simulation. A filtering method is described which was based on the hypothesis that all changes due to altitude increase can be represented by a point spread function. Determination of the scale function and factor are discussed as well as implementation of the filtering. Filtering can be either in the spatial or frequency domain. In the spatial domain, filtering consists of the convolution of the image with the weights mask, and then of the declination of the points according to the appropriates scale factor. A simulation of an aircraft day image in the infrared channel is examined. A.R.H.

N81-13403*# Milan Univ. (Italy). Instituto di Geofisica.
A SIMULATION MODEL OF TEMPERATURE TRANSITORY ON ROCKS HAVING DIFFERENT THERMAL INERTIA. ANALYSIS OF THE THEORETICAL CAPACITY OF ROCK DISCRIMINATION BY REMOTE SENSING DATA Progress Report
R. Cassinis, Principal Investigator and Nicola Tosi Oct. 1980 36 p refs Sponsored by NASA HCMM
(E81-10042; NASA-CR-163752; PR-3) Avail: NTIS HC A03/MF A01 CSCL 08G

The possibility of identifying ground surface material by measuring the surface temperature at two different and significant times of the day was investigated for the case of hypothetical island whose rocky surface contained no vegetation and consisted of dolomite, clay, and granite. The thermal dynamics of the soil surface during a day in which atmospheric conditions were average for a latitude of about 40 deg to 50 deg were numerically simulated. The line of separation between zones of different materials was delineated by the range of temperature variation. Results show that the difference between maximum and minimum value of the temperature of ground surface during the day is linked to the thermal inertia value of the material of which the rock is formed. A.R.H.

N81-13404*# Royal Australian Navy Research Lab., Edgecliff.
HEAT CAPACITY MAPPING MISSION Progress Report, period ending 31 Aug. 1980
C. S. Nilsson, J. C. Andrews, P. Scully-Power (Naval Underwater Systems Center, New London, Conn.), S. Ball (Weapons Systems Research Lab., Salisbury, Australia), G. Speechley, and A. R. Latham, Principal Investigators Sep. 1980 41 p Sponsored by NASA Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(E81-10043; NASA-CR-163753) Avail: NTIS HC A03/MF A01 CSCL 08B

The Tasman Front was delineated by airborne expendable bathythermograph survey; and an Heat Capacity Mapping Mission (HCMM) IR image on the same day shows the same principal features as determined from ground-truth. It is clear that digital enhancement of HCMM images is necessary to map ocean surface temperatures and when done, the Tasman Front and other oceanographic features can be mapped by this method, even through considerable scattered cloud cover. M.G.

N81-13405*# Environmental Research and Technology, Inc., Concord, Mass.

INVESTIGATION OF THE APPLICATION OF HCMM THERMAL DATA TO SNOW HYDROLOGY Quarterly Progress Report, Jul. - Oct. 1980

James C. Barnes, Principal Investigator Oct. 1980 5 p HCMM

(Contract NAS4-24316)

(E81-10045; NASA-CR-163755; QPR-12) Avail: NTIS HC A02/MF A01 CSCL 08L

All heat capacity mapping mission (HCMM) data needed for the investigation were received, including the imagery and CCT's for the April 1979 day/night registered data set for the Sierras study area. Three sets of excellent data for the Sierras study were received. Analysis of the earlier two sets (late May and mid July 1978) was completed. Initial examination of the latest imagery received indicates that the April 1979 data are the best quality HCMM day/night registered data of the three data sets. The thermal inertia imagery is particularly outstanding, appearing to contain much more detail and information than the earlier thermal inertia images. R.C.T.

N81-13406*# Brown Univ., Providence, R. I. Dept. of Geological Sciences.

ELECTROMAGNETIC DEEP-PROBING (100-1000 KMS) OF THE EARTH'S INTERIOR FROM ARTIFICIAL SATELLITES: CONSTRAINTS ON THE REGIONAL EMPLACEMENT OF CRUSTAL RESOURCES Quarterly Progress Report, 1 Jul. - 30 Sep. 1980

John F. Hermance, Principal Investigator 20 Oct. 1980 13 p ERTS

(Contract NAS5-26138)

(E81-10046; NASA-CR-163756; QPR-1) Avail: NTIS HC A02/MF A01 CSCL 08G

The applicability of electromagnetic deep sounding experiments using natural sources in the magnetosphere by incorporating Magsat data with other geophysical data was evaluated. Magsat satellite data, ground based magnetic observations, appropriate reference field models, and other satellite data was analyzed. The optimal combination of observations which lead first to a global and then to a regional characterization of the conductivity of the Earth's upper mantle is sought. E.D.K.

N81-13407*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

PRELIMINARY ANALYSIS OF THE POTENTIAL OF LANDSAT IMAGERY TO STUDY DESERTIFICATION

Nelson deJesusParada, Principal Investigator, Magda Adelaide Lombardo, and Vitor Celso deCarvalho Jun. 1980 10 p refs Presented at the 14th Intern. Symp. on Remote Sensing of Environ., San Jose, Costa Rica, 23-30 Apr. 1980 Sponsored by NASA ERTS

(E81-10047; NASA-CR-163757; INPE-1789-RPE/161) Avail: NTIS HC A02/MF A01 CSCL 05B

The use of LANDSAT imagery to define and delimit areas under process of desertification was investigated. Imagery for two different years (1973 and 1978) and two different seasons (dry and rainy seasons in 1976), were used to identify terrain morphology and vegetation cover. The analysis of LANDSAT interpretation, combined with geological and soil information obtained from published literature, allowed the identification of eleven ecological units which were classified corresponding to the degree of the Xique-Xique region of Rio Sao Francisco. A.R.H.

N81-13408*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

APPLICATION OF REMOTE SENSING TO THE GEOLOGICAL STUDY OF THE ALKALINE COMPLEX REGION OF ITATIAIA [APLICACAO DE SENSORIAMENTO REMOTO AO ESTUDADA GEOLOGIA NA REGIAO DO COMPLEXO ALCALINO DE ITATIAIA]

Nelson deJesusParada, Principal Investigator and Jose Eduardo Rodrigues Aug. 1980 9 p refs In PORTUGUESE; ENGLISH summary Presented at the 32nd Reuniao Anual da Soc. Brasil. para o Progr. da Ciencia (SBPC), Rio de Janeiro, 6-12 Jul. 1980 Sponsored by NASA ERTS

(E81-10048; NASA-CR-163758) Avail: NTIS HC A02/MF A01 CSCL 08G

The methodology of remote sensing applied to geological study in a complex area was evaluated. Itatiaia was selected as a test area, which covers the alkaline massives and its precambrian basement. LANDSAT-MSS and radar mosaic of the RADAMBRASIL Project were used for photointerpretation. Previous geological works were consulted and many discrepancies in the distribution of stratigraphic units were found. Moreover, structural lineaments and talus deposits were clearly delineated. M.G.

N81-13409*# London Univ. (England).

HCMM IMAGERY FOR THE DISCRIMINATION OF ROCK TYPES, THE DETECTION OF GEOTHERMAL ENERGY SOURCES AND THE ASSESSMENT OF SOIL MOISTURE CONTENT IN WESTERN QUEENSLAND AND ADJACENT PARTS OF NEW SOUTH WALES AND SOUTH AUSTRALIA Progress Report

Monica M. Cole, Principal Investigator 30 Apr. 1980 4 p Sponsored by NASA HCMM

(E81-10050; NASA-CR-163760) Avail: NTIS HC A02/MF A01 CSCL 05B

Only photographic prints and negative films of day-visible, day-IR and night-IR imagery were received. For northwest Queensland, only five day-visible and day-IR frames of acceptable quality were received. A master-grid was established over these frames within which selected grid sections are being enlarged photographically for the identification of stream courses and geological features permitting an interpretation of the imagery relative to ground truth information. The imagery is also being scanned and digitized using a Joyce-Loebl microdensitometer for classification purposes. For areas for which good quality HCMM imagery is available, valuable information is obtained on ephemeral and seasonal drainage systems. The day-IR cover is particularly helpful. A.R.H.

N81-13410*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

APPLICATION OF REMOTE SENSING TECHNIQUES TO HYDROGRAPHY WITH EMPHASIS ON BATHYMETRY M.S. Thesis [APLICACAO DE TECHNICA DE SENSORES REMOTOS NA HIDROGRAFIA, COM ENFASE A BATIMETRIA]

Nelson deJesusParada, Principal Investigator and Domingos Sergio Meireles Jan. 1980 240 p refs In PORTUGUESE Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(E81-10052; NASA-CR-163762; INPE-1673-TDL/013) Avail: NTIS HC A11/MF A01 CSCL 08H

Remote sensing techniques are utilized for the determination of hydrographic characteristics, with emphasis in bathymetry. Two sensor systems were utilized: the Metric Camera Wild RC-10 and the Multispectral Scanner of LANDSAT Satellite (MSS-LANDSAT). From photographs of the metric camera, data of photographic density of points with known depth are obtained. A correlation between the variables density x depth is calculated through a regression straight line. From this line, the depth of points with known photographic density is determined. The LANDSAT MSS images are interpreted automatically in the Iterative Multispectral Analysis System (I-100) with the obtention of point subareas with the same gray level. With some simplifications done, it is assumed that the depth of a point is directly related with its gray level. Subareas with points of the same depth are then determined and isobathymetric curves are drawn. The coast line is obtained through the sensor systems already mentioned. Advantages and limitations of the techniques and of the sensor systems utilized are discussed and the results are compared with ground truth. E.D.K.

N81-13411*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

SOME ASPECTS OF GEOLOGICAL INFORMATION CONTAINED IN LANDSAT IMAGES [ALGUHS ASPECTOS DAS INFORMACOES GEOLOGICAS CONTIDAS EM IMAGENS LANDSAT]

Nelson deJesusParada, Principal Investigator, Chan Chiang Liu, Icaro Vitorello, and Paulo Roberto Meneses Jul. 1980 16 p refs In PORTUGUESE; ENGLISH summary Presented at the 31st Congr. Brasil de Geol. da Soc. Brasil. de Geol., Camboriu, Santa Catarina, 19-25 Oct. 1980 Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(E81-10053; NASA-CR-163763; INPE-1822-RPE/188) Avail: NTIS HC A02/MF A01 CSCL 08G

The characteristics of MSS images and methods of interpretation are analyzed from a geological point of view. The supportive role of LANDSAT data are illustrated in several examples of surface expressions of geological features, such as synclines and anticlines, spectral characteristics of lithologic units, and circular impact structures. E.D.K.

N81-13412*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ANALYSIS OF THE ORIGIN OF AUFEIS FEED-WATER ON THE ARCTIC SLOPE OF ALASKA

Dorothy K. Hall and Charles Roswell, Principal Investigator (Maryland Univ., College Park) Aug. 1980 45 p refs Submitted for publication Original contains imagery. Original photography may be purchased for the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(E81-10054; NASA-TM-81992) Avail: NTIS HC A03/MF A01 CSCL 08H

The origin of water feeding large aufeis fields (overflow river ice) on the Arctic Slope of Alaska is analyzed. Field measurements of two large aufeis fields on the eastern Arctic Slope were taken during July of 1978 and 1979. Measurements of aufeis extent and distribution were made using LANDSAT Multispectral Scanner Subsystem (MSS) satellite data from 1973 through 1979. In addition, ice cores were analyzed in the laboratory. Results of the field and laboratory studies indicate that the water derived from aufeis melt water has a chemical composition different from the adjacent upstream river water. Large aufeis fields are found in association with springs and faults thus indicating a subterranean origin of the feed water. In addition, the maximum extent of large aufeis fields was not found to follow meteorological patterns which would only be expected if the origin of the feed water were local. It is concluded that extent of large aufeis in a given river channel on the Arctic Slope is controlled by discharge from reservoirs of groundwater. It seems probable that precipitation passes into limestone aquifers in the Brooks Range, through an interconnecting system of subterranean fractures in calcareous rocks and ultimately discharges into alluvial sediments on the coastal plain to form aufeis. It is speculated that only small aufeis patches are affected by local meteorological parameters in the months just prior to aufeis formation. E.D.K.

N81-13413*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

APPLICATION OF DIGITAL TERRAIN DATA TO QUANTIFY AND REDUCE THE TOPOGRAPHIC EFFECT ON LANDSAT DATA

C. O. Justice, S. W. Wharton, and B. N. Holben, Principal Investigators Aug. 1980 35 p refs Submitted for publication Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198

(E81-10055; NASA-TM-81988) Avail: NTIS HC A03/MF A01 CSCL 05B

Integration of LANDSAT multispectral scanner (MSS) data with 30 m U.S. Geological Survey (USGS) digital terrain data was undertaken to quantify and reduce the topographic effect on imagery of a forested mountain ridge test site in central Pennsylvania. High Sun angle imagery revealed variation of as much as 21 pixel values in data for slopes of different angles and aspects with uniform surface cover. Large topographic effects were apparent in MSS 4 and 5 was due to a combination of high absorption by the forest cover and the MSS quantization. Four methods for reducing the topographic effect were compared. Band ratioing of MSS 6/5 and MSS 7/5 did not eliminate the topographic effect because of the lack of variation in MSS 4 and 5 radiances. The three radiance models examined to reduce the topographic effect required integration of the digital terrain data. Two Lambertian models increased the variation in the LANDSAT radiances. The nonLambertian model considerably reduced (86 per cent) the topographic effect in the LANDSAT data. The study demonstrates that high quality digital terrain data, as provided by the USGS digital elevation model data, can be used to enhance the utility of multispectral satellite data. Author

N81-13414*# Joint Research Centre of the European Communities, Ispra (Italy).

HCMM SATELLITE FOLLOW-ON INVESTIGATION NO. 25. SOIL MOISTURE AND HEAT BUDGET EVALUTION IN SELECTED EUROPEAN ZONES OF AGRICULTURAL AND ENVIRONMENTAL INTEREST (TELLUS PROJECT) Progress Report, 31 Apr. - 31 Aug. 1980

31 Aug. 1980 48 p refs Sponsored by NASA HCMM (Proj. TELLUS)

(E81-10057; NASA-CR-163765; PR-3) Avail: NTIS HC A03/MF A01 CSCL 08M

A simple procedure to evaluate actual evaporation was derived by linearizing the surface energy balance equation, using Taylor's expansion. The original multidimensional hypersurface could be reduced to a linear relationship between evaporation and surface temperature or to a surface relationship involving evaporation, surface temperature and albedo. This procedure permits a rapid sensitivity analysis of the surface energy balance equation as well as a speedy mapping of evaporation from remotely sensed surface temperatures and albedo. Comparison with experimental data yielded promising results. The validity of evapotranspiration and soil moisture models in semiarid conditions was tested. Wheat was the crop chosen for a continuous measurement campaign made in the south of Italy. Radiometric, micrometeorologic, agronomic and soil data were collected for processing and interpretation. E.D.K.

N81-13415*# Joint Research Centre of the European Communities, Ispra (Italy).

THE JOINT MEASURING CAMPAIGN 1979 IN RUTHE (WEST GERMANY) DESCRIPTION AND PRELIMINARY DATA

R. R. vanderPloeg, G. Tassone, and J. vonHoyningen-Huene, Principal Investigators 1979 252 p refs Sponsored by NASA HCMM

(Proj. TELLUS)

(E81-10058; NASA-CR-163766) Avail: NTIS HC A12/MF A01 CSCL 08B

The measurements and observations performed as part of the TELLUS project on soil moisture and heat budget evaluations of selected areas in the vecinity of Ruthe, West Germany are presented and discussed. The main lines of investigation include evapotranspiration and moisture content in bare soils covered by vegetation, interactions between natural phenomena and mesoscale heat budget, and man made changes and their impact on regional heat budget. M.G.

N81-13416*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

AN APPLICATION EXAMPLE OF THE LANDSAT DATA TO THE STUDY OF THE RELATIONSHIP BETWEEN THE TOPOGRAPHY AND PASTURE QUALITY IN AREAS OF PARAGOMINAS [EXEMPLO DE APLICACAO DE DADOS DO SISTEMA LANDSAT, NO ESTUDO DAS RELACOES ENTRE COMPARTIMENTACAO TOPOGRAFICA E QUALIDADE DE PASTAGENS NO MUNICIPIO DE PARAGOMINAS (PA)]

Nelson deJesusParada, Principal Investigator, Armando P. dosSantos, Evelyn Marcia Leao deMoraesNovo, and Valdete Duarte Jun. 1980 76 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA Original contains color illustrations ERTS

(E81-10059; NASA-CR-163767; INPE-1756-RPE/145) Avail: NTIS HC A05/MF A01 CSCL 02C

The relationship between pasture quality and geomorphology was verified by applying visual and automatic interpretation

techniques to LANDSAT data. The results show that LANDSAT data is useful to point out better areas to settle pastures.Author

N81-13417*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
TAPE MERGE/COPY PROCESSOR
S. O. OBrien, Principal Investigator Sep. 1980 11 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E81-10060; NASA-CR-162863; EW-LO-00704; LEMSCO-15356; JSC-16381) Avail: NTIS HC A02/MF A01 CSCL 05B

The TAPMRG processor merges or copies data files from one or more tapes onto a single output tape. Author

N81-13418*# Tokyo Univ. (Japan). Geophysics Research Lab.
[STUDYING INTERNAL AND EXTERNAL MAGNETIC FIELDS IN JAPAN USING MAGSAT DATA] Progress Report, 15 Jul. - 15 Nov. 1980
Naoshi Fukushima, Principal Investigators, H. Maeda, T. Yukutake, M. Tanaka, S. Oshima, K. Ogawa, M. Kawamura, Y. Miyazaki, S. Uyeda, K. Kobayashi et al 28 Nov. 1980 7 p ERTS
(E81-10062; NASA-CR-163769; PR-1) Avail: NTIS HC A02/MF A01 CSCL 08G

Examination of the total intensity data of CHRONIT on a few paths over Japan and its neighboring sea shows MAGSAT is extremely useful for studying the local magnetic anomaly. In high latitudes, the signatures of field aligned currents are clearly recognized. These include (1) the persistent basic pattern of current flow; (2) the more intense currents in the summer hemisphere than in the winter hemisphere; (3) more fluctuations in current intensities in summer dawn hours; and (4) apparent dawn-dusk asymmetry in the field-aligned current intensity between the north and south polar regions. A.R.H.

N81-13419*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GEOLOGIC APPLICATION OF THERMAL INERTIA IMAGING USING HCMM DATA Quarterly Report, Jul. - Sep. 1980
Helen N. Paley and Anne B. Kahle, Principal Investigators Oct. 1980 5 p HCMM
(Contract NAS7-100)
(E81-10063; NASA-CR-163770) Avail: NTIS HC A02/MF A01 CSCL 08B

During the July to September 1980 quarter the final tapes were received completing the order and preliminary processing was done. Thermal Inertia images for each of the three test sites, Death Valley and Pisgah Crater, California and Goldfield, Nevada were created using registered HCMM day/night pairs and the JPL model. A comprehensive study and analysis of the geologic application of all acquired HCMM data is in progress. E.D.K.

N81-13420*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
JOINT MICROWAVE AND INFRARED STUDIES FOR SOIL MOISTURE DETERMINATION
E. G. Njoku, J. P. Schieldge, and A. B. Kahle, Principal Investigators 15 Sep. 1980 129 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, Agency for International Development ERTS
(Contract NAS7-100; Proj. AgRISTARS)
(E81-10064; NASA-CR-163771; SM-YO-00495; JPL-80-57) Avail: NTIS HC A07/MF A01 CSCL 02C

The feasibility of using a combined microwave-thermal infrared system to determine soil moisture content is addressed. Of particular concern are bare soils. The theoretical basis for microwave emission from soils and the transport of heat and moisture in soils is presented. Also, a description is given of the results of two field experiments held during vernal months in the San Joaquin Valley of California. M.G.

N81-13421*# Texas A&M Univ., College Station. Remote Sensing Center.
DRYLAND PASTURE AND CROP CONDITIONS AS SEEN BY HCMM Progress Report, Apr. - Jul. 1980
W. D. Rosenthal, J. C. Harlan, and Bruce J. Blanchard, Principal Investigators Jul. 1980 14 p HCMM
(Contract NAS5-24383)
(E81-10065; NASA-CR-163772; PR-3712-10) Avail: NTIS HC A02/MF A01 CSCL 02C

Heat capacity mapping mission data were obtained for use in enhancing estimates of soil moisture content. Day/day thermal IR difference between data from August 31 and October 17 were analyzed. Atmospheric correction on HCMM pass dates using the RADTRA model were calculated. Differences between corrections using lake temperatures and calculated temperatures were small. R.C.T.

N81-13422*# Environmental Research Inst. of Michigan, Ann Arbor.
LANDSAT TECHNOLOGY TRANSFER TO THE PRIVATE AND PUBLIC SECTORS THROUGH COMMUNITY COLLEGES AND OTHER LOCALLY AVAILABLE INSTITUTIONS Quarterly Progress Report, May - Aug. 1980
Robert H. Rogers, Principal Investigator Sep. 1980 68 p refs ERTS
(Contract NASw-3308)
(E81-10066; NASA-CR-163773; ERIM-147200-10-P; QPR-2) Avail: NTIS HC A04/MF A01 CSCL 05A

The results achieved during the first eight months of a program to transfer LANDSAT technology to practicing professionals in the private and public sectors (grass roots) through community colleges and other locally available institutions are reported. The approach offers hands-on interactive analysis training and demonstrations through the use of color desktop computer terminals communicating with a host computer by telephone lines. The features of the terminals and associated training materials are reviewed together with plans for their use in training and demonstration projects. E.D.K.

N81-13423*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
TRES MARIAS RESERVOIR, MINAS GERAIS STATE: STUDY OF THE DISPERSION OF SUSPENDED SEDIMENTS IN SURFACE WATERS USING ORBITAL IMAGES
Nelson deJesusParada, Principal Investigator and Tania Maria Sausen Jun. 1980 16 p Presented at the 14th Intern. Symp. on Remote Sensing of Environ., San Jose, Costa Rica, 23-30 Apr. 1980 Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E81-10067; NASA-CR-163774; INPE-1788-RPE/160) Avail: NTIS HC A02/MF A01 CSCL 08H

Computer compatible tapes from LANDSAT were used to compartmentalize the Ires Marias reservoir according to respective grey level spectral response. Interactive and automatic, supervised classification, was executed from the IMAGE-100 system. From the simple correlation analysis and graphic representation, it is shown that grey tone levels are inversely proportional to Secchi Depth values. It is further shown that the most favorable period to conduct an analysis of this type is during the rainy season. R.C.T.

N81-13424*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
STUDY OF THE CERRADO VEGETATION IN THE FEDERAL DISTRICT AREA FROM ORBITAL DATA M.S. Thesis [ESTUDO DA VEGETACAO DE CERRADO NA AREA DO DISTRITO FEDERAL, A PARTIR DE DADOS ORBITAIS]
Nelson deJesusParada, Principal Investigator, Hideyo Aoki, and Joao Roberto dosSantos May 1980 51 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E81-10068; NASA-CR-163775; INPE-1730-TDL/026) Avail: NTIS HC A08/MF A01 CSCL 02F

The physiognomic units of cerrado in the area of Distrito Federal (DF) were studied through the visual and automatic analysis of products provided by Multispectral Scanning System (MSS) of LANDSAT. The visual analysis of the multispectral images in black and white, at the 1:250,000 scale, was made based on the texture and tonal patterns. The automatic analysis of the compatible computer tapes (CCT) was made by means

of IMAGE-100 system. The following conclusions were obtained: (1) the delimitation of cerrado vegetation forms can be made by the visual and automatic analysis; (2) in the visual analysis, the principal parameter used to discriminate the cerrado forms was the tonal pattern, independently of the year's seasons, and the channel 5 gave better information; (3) in the automatic analysis, the data of the four channels of MSS can be used in the discrimination of the cerrado forms; and (4) in the automatic analysis, the four channels combination possibilities gave more information in the separation of cerrado units when soil types were considered. E.D.K.

N81-13425*# Houston Univ., Tex. Dept. of Mathematics.

NUMERICAL TRIALS OF HISSE

Charles Peters and Frank Kampe, Principal Investigators 5 Aug. 1980 28 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS

(Contract NAS9-14689; Proj. AgRISTARS)

(E81-10069; NASA-CR-160881; SR-HO-00477) Avail: NTIS HC A03/MF A01 CSCL 02C

The mathematical description and implementation of the statistical estimation procedure known as the Houston integrated spatial/spectral estimator (HISSE) is discussed. HISSE is based on a normal mixture model and is designed to take advantage of spectral and spatial information of LANDSAT data pixels, utilizing the initial classification and clustering information provided by the AMOEBA algorithm. The HISSE calculates parametric estimates of class proportions which reduce the error inherent in estimates derived from typical classify and count procedures common to nonparametric clustering algorithms. It also singles out spatial groupings of pixels which are most suitable for labeling classes. These calculations are designed to aid the analyst/interpreter in labeling patches with a crop class label. Finally, HISSE's initial performance on an actual LANDSAT agricultural ground truth data set is reported. E.D.K.

N81-13426*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

NORMAL CROP CALENDARS. VOLUME 2: THE SPRING WHEAT STATES OF MINNESOTA, MONTANA, NORTH DAKOTA, AND SOUTH DAKOTA

William L. West, III, Principal Investigator Aug. 1980 24 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AgRISTARS)

(E81-10070; NASA-CR-160867; SR-LO-00485; LEMSCO-15034; JSC-16814) Avail: NTIS HC A02/MF A01 CSCL 02C

The state crop calendars for the principal spring wheat producing states within the United States are presented. These crop calendars are an update of those produced for the large area crop inventory experiment multilabeling task during 1978 and are compiled for the foreign commodity production forecasting (FCPF) project of the agriculture and resources inventory surveys through aerospace remote sensing program. R.C.T.

N81-13427*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

PRELIMINARY EVALUATION OF THE ENVIRONMENTAL RESEARCH INSTITUTE OF MICHIGAN CROP CALENDAR SHIFT ALGORITHM FOR ESTIMATION OF SPRING WHEAT DEVELOPMENT STAGE

D. E. Phinney, Principal Investigator Sep. 1980 20 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AgRISTARS)

(E81-10071; NASA-CR-160865; SR-LO-00476; LEMSCO-15115; JSC-16377) Avail: NTIS HC A02/MF A01 CSCL 02C

An algorithm for estimating spectral crop calendar shifts of spring small grains was applied to 1978 spring wheat fields. The algorithm provides estimates of the date of peak spectral response by maximizing the cross correlation between a reference profile and the observed multitemporal pattern of Kauth-Thomas greenness for a field. A methodology was developed for estimation of crop development stage from the date of peak spectral response. Evaluation studies showed that the algorithm provided stable estimates with no geographical bias. Crop development stage estimates had a root mean square error near 10 days. The algorithm was recommended for comparative testing against other models which are candidates for use in AgRISTARS experiments. E.D.K.

N81-13428*# *Lockheed Engineering and Management Services* Co., Inc., Houston, Tex.

LIMITED AREA COVERAGE/HIGH RESOLUTION PICTURE TRANSMISSION (LAC/HRPT) TAPE IJ GRID PIXEL EXTRACTION PROCESSOR USER'S MANUAL

S. O. OBrien, Principal Investigator Sep. 1980 14 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AgRISTARS)

(E81-10072; NASA-CR-160866; EW-LO-00702; LEMSCO-15326; JSC-16374) Avail: NTIS HC A02/MF A01 CSCL 05B

The program, LACREG, extracted all pixels that are contained in a specific IJ grid section. The pixels, along with a header record are stored in a disk file defined by the user. The program will extract up to 99 IJ grid sections. Author

N81-13429*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

LIMITED AREA COVERAGE/HIGH RESOLUTION PICTURE TRANSMISSION (LAC/HRPT) DATA VEGETATIVE INDEX CALCULATION PROCESSOR USER'S MANUAL

S. O. OBrien, Principal Investigator Sep. 1980 14 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AgRISTARS)

(E81-10073; NASA-CR-160870; EW-LO-00703; LEMSCO-15327; JSC-16375) Avail: NTIS HC A02/MF A01 CSCL 08F

The program, LACVIN, calculates vegetative indexes numbers on limited area coverage/high resolution picture transmission data for selected IJ grid sections. The IJ grid sections were previously extracted from the full resolution data tapes and stored on disk files. Author

N81-13430*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

EROS TO UNIVERSAL TAPE CONVERSION PROCESSOR

S. O. OBrien, Principal Investigator Sep. 1980 11 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AgRISTARS)

(E81-10074; NASA-CR-160869; EW-LO-00705; LEMSCO-15357; JSC-16382) Avail: NTIS HC A02/MF A01 CSCL 05B

The function of the EROS processor is to allow a user to select a specific area from a full frame LANDSAT image which is written on tape in the EROS format. The area of interest is read from the EROS formatted tape and converted to the JSC Universal format and written onto another tape. This tape can then be read by the IMDACS processing system and normal analysis can be performed. Author

N81-13431*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

NORMAL CROP CALENDARS. VOLUME 1: ASSEMBLY AND APPLICATION OF HISTORICAL CROP DATA TO A STANDARD PRODUCT

William L. West, III, Principal Investigator Aug. 1980 21 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AgRISTARS)

(E81-10075; NASA-CR-160868; SR-LO-00484; LEMSCO-15033; JSC-16813) Avail: NTIS HC A02/MF A01 CSCL 02C

The approach used in the collection, collation, and compilation of normal crop calendar for the foreign commodity production forecasting (FCPF) project of the AgRISTARS program is described. A.R.H.

N81-13432*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

EVALUATION OF RESULTS OF US CORN AND SOYBEANS EXPLORATORY EXPERIMENT: CLASSIFICATION PROCEDURES VERIFICATION TEST

J. G. Carnes and J. E. Baird, Principal Investigators Sep. 1980 39 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior, and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AGRISTARS)

(E81-10076; NASA-CR-160873; FC-LO-00423; LEMSCO-14386; JSC-16339) Avail: NTIS HC A03/MF A01 CSCL 02C

The classification procedure utilized in making crop proportion estimates for corn and soybeans using remotely sensed data was evaluated. The procedure was derived during the transition year of the Large Area Crop Inventory Experiment. Analysis of variance techniques were applied to classifications performed by 3 groups of analysts who processed 25 segments selected from 4 agrophysical units (APU's). Group and APU effects were assessed to determine factors which affected the quality of the classifications. The classification results were studied to determine the effectiveness of the procedure in producing corn and soybeans proportion estimates. A.R.H.

N81-13433*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

LIMITED AREA COVERAGE/HIGH RESOLUTION PICTURE TRANSMISSION, LAC/HRPT TAPE CONVERSION PROCESSOR USER'S MANUAL

S. O. OBrien, Principal Investigator Sep. 1980 14 p Sponsored by NASA, USDA, Dept of Commerce, Dept. of Interior, and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AgRISTARS)

(E81-10077; NASA-CR-160871; EW-LO-00701; LEMSCO-15325; JSC-16373) Avail: NTIS HC A02/MF A01 CSCL 05B

The program, LACSEG, converts LAC/HRPT data tapes to the CSC defined Universal format. The Universal formatted data tape is then processed the normal way by the FAS IMDACS system. Author

N81-13434*# Mississippi State Univ., Mississippi State.

APPLICATION OF REMOTE SENSING TO STATE AND REGIONAL PROBLEMS Semiannual Progress Report, 1 May - 31 Oct. 1980

W. Frank Miller, Bradley D. Carter, Jimmy L. Solomon, Sidney G. Williams, John S. Powers, and Jon R. Clark, Principal Investigators 1 Nov. 1980 63 p Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(Grant NGR-25-001-054)

(E81-10078; NASA-CR-163776; SAPR-14) Avail: NTIS HC A04/MF A01 CSCL 08B

Progress is reported in the following areas: remote sensing applications to land use planning Lowndes County, applications of LANDSAT data to strip mine inventory and reclamation, white tailed deer habitat evaluation using LANDSAT data, remote sensing data analysis support system, and discrimination of unique forest habitats in potential lignite areas of Mississippi. Other projects discussed include LANDSAT change discrimination in gravel operations, environmental impact modeling for highway corridors, and discrimination of fresh water wetlands for inventory and monitoring. E.D.K.

N81-13435*# Pennsylvania State Univ., University Park. Dept. of Meteorology.

REMOTE ESTIMATION OF THE SURFACE CHARACTERISTICS AND ENERGY BALANCE OVER AN URBAN-RURAL AREA AND THE EFFECTS OF SURFACE HEAT FLUX ON PLUME SPREAD AND CONCENTRATION M.S. Thesis

Donald Charles DiCristofaro, Principal Investigator Nov. 1980 122 p refs Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to 'Attn: National Space Science Data Center': non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM

(Contract NAS5-24264; Grants EPA-R-806048; EPA-R-805640)

(E81-10082; NASA-CR-163780) Avail: NTIS HC A07/MF A01 CSCL 13B

A one dimensional boundary layer model was used in conjunction with satellite derived infrared surface temperatures to deduce values of moisture availability, thermal inertia, heat and evaporative fluxes. The Penn State satellite image display system, a sophisticated image display facility, was used to remotely sense these various parameters for three cases: St. Louis, Missouri; the Land Between the Lakes, Kentucky; and Clarksville, Tennessee. The urban centers displayed the maximum daytime surface temperatures which correspond to the minimum values of moisture availability. The urban center of St. Louis and the bodies of water displayed the maximum nighttime surface temperatures which correspond to the maximum thermal inertia values. It is shown that moisture availability and thermal inertia are very much responsible for the formation of important temperature variations over the urban rural complex. R.C.T.

N81-13436*# Lille Univ. (France). Lab. D'Optique Atmospherique.

SEA SURFACE TEMPERATURE OF THE COASTAL ZONES OF FRANCE Progress Report

P. Y. Deschamps, F Verger (Ecole Normale Superieure, Montrouge, France), J. M. Monget (Ecole des Mines, Valbonne, France), M. Crepon, Principal Investigators (Museum d'Historie Naturelle, Paris), R. Frouin, J. Cassanet (Ecole Normale Superieure, Monbonne, France), and L. Wald (Ecole des Mines, Valbonne, France) Aug. 1980 94 p refs Sponsored by NASA Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM

(E81-10083; NASA-CR-163781; PR-4) Avail: NTIS HC A05/MF A01 CSCL 08J

The results of an investigation to map the various thermal gradients in the coastal zones of France are presented. Particular emphasis is given to the natural phenomena and man made thermal effluents. It is shown that a close correlation exist between wind speed direction and the offshore width of the effluent. R.C.T.

N81-13437*# Business and Technological Systems, Inc., Seabrook, Md.

GEOMAGNETIC FIELD MODELING BY OPTIMAL RECURSIVE FILTERING Quarterly Report, 11 Jul. - 30 Sep. 1980

30 Sep. 1980 4 p ERTS

(Contract NAS5-26250)

(E81-10084; NASA-CR-163782; QR-1) Avail: NTIS HC A02/MF A01 CSCL 08G

Data sets selected for mini-batches and the software modifications required for processing these sets are described. Initial analysis was performed on minibatch field model recovery. Studies are being performed to examine the convergence of the solutions and the maximum expansion order the data will support in the constant and secular terms. E.D.K.

N81-13438*# Herzberg Inst. of Astronomy, Ottawa (Ontario). Inst. of Astrophysics.

STUDIES OF HIGH LATITUDE CURRENT SYSTEMS USING MAGSAT VECTOR DATA Triennial Progress Report, 1 Jul. - 15 Nov. 1980

J. Ronald Burrows, T. J. Hughes, D. D. Wallis, and Margaret D. Wilson, Principal Investigators 1 Dec. 1980 16 p Sponsored by NASA ERTS

(E81-10085; NASA-CR-163785; PR-1) Avail: NTIS HC A02/MF A01 CSCL 04A

Disturbance fields caused by global external current systems are analyzed in order to gain an improved understanding of the physical processes which control high latitude current systems and to increase the confidence level in the identification of internal field levels. The basic approach is to: (1) categorize the vector data by those physical parameters important for investigation of external current systems; (2) map the disturbances for appropriate conditions; (3) model the currents which might cause the mapped disturbances; and (4) correlate results with data from other sources. It is concluded that the Magsat data set appears to have remarkably high precision and quality and should permit

major advances to be made in modeling current distribution at high latitudes in the ionosphere and magnetosphere. E.D.K.

N81-13439*# Energy, Mines and Resources Canada, Ottawa (Ontario). Geomagnetic Service.
THE REDUCTION, VERIFICATION AND INTERPRETATION OF MAGSAT MAGNETIC DATA OVER CANADA Progress Report
R. L. Coles, G. Jansen vanBeek, G. V. Haines, E. Dawson, and J. K. Walker, Principal Investigators Nov. 1980 16 p refs ERTS
(E81-10086; NASA-CR-163786) Avail: NTIS HC A02/MF A01 CSCL 05B

The primary concern of this investigation is to detect and study variations in the magnetic field originating in the solid Earth, as measured by Magsat. Most of this field originates in the core, but an important part of the field is of lithospheric origin. Magnetic anomalies of lithospheric origin are weak at Magsat altitudes (20 to 30 nT at most), and they can easily be masked by much larger effects caused by field aligned and other currents at high latitudes. Most of Canada lies under the influence of ionospheric currents in the auroral zone and polar cap. Therefore, before Magsat data had become available, but after the October 30, 1979 launch, criteria were developed for selecting times when subsets of potentially usable Magsat data could be expected. Subsequently, as Magsat data became available, these critieria were applied. E.D.K.

N81-13440# Naval Ocean Research and Development Activity, Bay St. Louis, Miss. Ocean Science and Technology Lab.
EASTERN ARCTIC SURSAT SAR ICE EXPERIMENT. RADAR SIGNATURES OF SEA ICE FEATURES
R. D. Ketchum, Jr. and L. Dennis Farmer Aug. 1980 43 p refs
(AD-A090629; NORDA-TN-68) Avail: NTIS HC A03/MF A01 CSCL 17/9

Evaluation of X- and L-band steep angle synthetic aperture radar (SAR) sea ice imagery taken in Baffin Bay and Davis Strait in April 1979 has shown that description and discrimination of first season ice types can be difficult because of ambiguous radar returns. Ambiguous returns seen on X-band radar imagery are attributed to snow cover. The data have indicated that changes in snow properties due to melting and refreezing cause development of a highly reflective medium to the 3 cm X-band radar. The 25 cm L-band radar is not noticeably affected by the observed phenomena, thus correlation of coincident X- and L-band imagery often resolves interpretation ambiguities on the X-band imagery caused by the snow effects. The data suggest that L-band radar energy often penetrates the ice and that subsurface returns are received. These returns also produce ambiguities in interpretation. Apparent smooth surfaces do not show this effect, but rough surfaces which have widely different roughness densities may produce apparently equal backscatter of L-band radar. Ice ridge identification and discrimination was often poor due to the obscuring effects of background clutter associated with the above-suggested backscattering phenomena. Small ridge sizes versus system resolution and steep angles of incidence also reduce ridge identification capabilities. Some icebergs produced time-delayed L-band signals, indicating internal reflections within the iceberg. Iceberg/water interface reflections rather than volume scattering are indicated. L-band radar cannot be depended upon for iceberg identification, since icebergs may be only partially imaged or not imaged at all by this frequency. GRA

N81-13441# Battelle Inst., Frankfurt am Main (West Germany).
INVESTIGATION INTO A METHODOLOGY OF ESTABLISHING AN AREAL TERRAIN DATA BASE, PHASE 3 Final Report
P. Jessel, W. Koeppel, and K. J. Melzer Dec. 1979 139 p refs
(Contract DAJA37-79-C-0242)
(AD-A090333; BF-R-64.058-2; FR-2) Avail: NTIS HC A07/MF A01 CSCL 02/6

This volume contains a compilation of vegetation field data, statistical stand table data and current forestry inventory data for a selected area of the FRG within two 1:50,000 scale quadrangle sheets Lauterbach (L 5322) and Hunfeld (L 5324). The data were used for assessing the applicability of existing vegetation terrain data modeling at the WES and necessary improvements. For these purposes, the four dominant German forest species (beech, oak, pine, spruce) were investigated. An approach was made to analyze current inventory data from forestry management books for selected compartments, modifying stand table data from statistical data sources plus investigating some selected field sites according to the common WES vegetation sampling procedures. Finally, a first evaluation on the feasibility of aerial photo interpretation was made for selected species found in West German forests. General procedures for predicting vegetation characteristics were derived for the species investigated. GRA

N81-13442# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
RADAR SCATTEROMETER MEASUREMENTS OF SEA ICE: THE SURSAT EXPERIMENT
C. V. Delker, R. G. Onstott, and R. K. Moore Aug. 1980 99 p refs
(Contract N00014-76-C-1105; NR Proj. 307-383)
(AD-A091239; CRINC/RSL-TR-331-17) Avail: NTIS HC A05/MF A01 CSCL 17/9

The radar backscatter properties of sea ice were measured using both a surface-based and a helicopter-borne scatterometer system. Thick first-year sea ice, thin first-year sea ice, brackish sea ice, and fresh-water inland lake ice were investigated. These ice sites were located off or near the Canadian coast at Tuktoyaktuk, N.W.T., Canada. This paper describes the field experiment, documents the sensors used, and presents the result obtained. Measurements in the 8-18 GHz region verify the ability of radar to distinguish between the different ice types. For angles of incidence greater than 40 degrees VV polarization and 9 GHz frequency appear to provide the best discrimination capability. A strong correlation between radar scattering cross-section and the salinity of ice was observed. Higher salinity ice types produced higher scattering coefficients. Effects of snow cover on lake ice were also investigated. Removal of the snow cover produced significantly lower scattering coefficients which demonstrates the importance of snow cover as a parameter in the radar backscatter return mechanisms of ice. GRA

N81-13443# Anacapa Sciences, Inc., Santa Barbara, Calif.
TOPOGRAPHIC INFORMATION REQUIREMENTS AND COMPUTER-GRAPHIC DISPLAY TECHNIQUES FOR NAP OF THE EARTH FLIGHT Annual Technical Report, Jan. - Dec. 1979
Steven P. Rogers and Kenneth D. Cross Dec. 1979 102 p refs
(Contract DAHC9-78-C-0012; DA Proj. 2Q1-62717-A-790)
(AD-A091240; AS-365-79; USAAVRADCOM-TR-78-0012-F)
Avail: NTIS HC A06/MF A01 CSCL 08/2

This report describes a study undertaken to identify tasks required of Army aviators performing terrain flight, and to determine the ways in which a computer-generated topographic display might aid in the conduct of these tasks. The report provides: (a) an inventory of the full range of preflight and inflight tasks performed by the Army aviator that require the use of map products, overlays, and geographic data; (b) a review of the recent developments and state-of-the-art in computer graphics technology that are applicable to the production of map products and related displays; and (c) descriptions of computer-graphic capabilities that have potential value for the conduct of flight planning, the conduct of navigation, and the accomplishment of related tasks. GRA

N81-13444# Center for Renewable Resources, Washington, D.C.
RENEWABLE RESOURCES: A NATIONAL CATALOG OF MODEL PROJECTS. VOLUME 1: NORTHEAST SOLAR ENERGY CENTER REGION
Jul. 1980 414 p 4 Vol.
(Contract DE-FG01-79CS-30098)
(DOE/CS-30098/01-Vol-1) Avail: NTIS HC A18/MF A01

This compilation of diverse conservation and renewable energy projects across the United States was prepared through the enthusiastic participation of solar and alternate energy groups from every state and region. Compiled and edited by the Center for Renewable Resources, these projects reflect many levels of innovation and technical expertise. In many cases, a critique

analysis is presented of how projects performed and of the institutional conditions associated with their success or failure.
DOE

N81-13445# Center for Renewable Resources, Washington, D.C.
RENEWABLE RESOURCES: A NATIONAL CATALOG OF MODEL PROJECTS. VOLUME 2: MID-AMERICAN SOLAR ENERGY COMPLEX REGION
Jul. 1980 444 p 4 Vol.
(Contract DE-FG01-79CS-30098)
(DOE/CS-30098/01-Vol-2) Avail: NTIS HC A19/MF A01
The projects reflect the research and development in solar technology. An analysis of each project's efficiency and success is presented. A wide range of technology utilization is shown.
T.M.

N81-13446# Center for Renewable Resources, Washington, D.C.
RENEWABLE RESOURCES: A NATIONAL CATALOG OF MODEL PROJECTS. VOLUME 3: SOUTHERN SOLAR ENERGY CENTER REGION
Jul. 1980 779 p 4 Vol.
(Contract DE-FG01-79CS-30098)
(DOE/CS-30098/01-Vol-3) Avail: NTIS HC A99/MF A01
The research management and technological utilization of each project was analyzed. The research and development of solar technologies is emphasized.
T.M.

N81-13447# Center for Renewable Resources, Washington, D.C.
RENEWABLE RESOURCES: A NATIONAL CATALOG OF MODEL PROJECTS. VOLUME 4: WESTERN SOLAR UTILIZATION NETWORK REGION
Jul. 1980 542 p 4 Vol.
(Contract DE-FG01-79CS-30098)
(DOE/CS-30098/01-Vol-4) Avail: NTIS HC A23/MF A01
The catalog presents an analysis of each project's research management effort and utilization of solar enrgy technologies. Information is presented to aid learning from these experiments.
T.M.

N81-13448# Harvard Univ., Cambridge, Mass. Inst. for Conservation Archaeology.
A SUMMARY AND ANALYSIS OF CULTURAL RESOURCE INFORMATION ON THE CONTINENTAL SHELF FROM THE BAY OF FUNDY TO CAPE HATTERAS. VOLUME 1: PHYSICAL ENVIRONMENT Final Report
Randall Moir 1979 287 p refs 4 Vol.
(Contract DI-AA551-CT8-18)
(PB80-220114; ICA-88-Vol-1; BLM/YL/SR-79/01-Vol-1) Avail: NTIS HC A13/MF A01 CSCL 13B
Prehistoric archaeology, its data base, and current formulations of culture history are discussed with emphasis on the continental shelf, coastal zone, and nearby low elevation terrestrial areas from Maine to North Carolina. Known archaeological sites are considered as well as predicted site distributions on the present land and on the shelf. Relevant paleontology of the continental shelf is examined with focus on the aboriginal cultural tradition from 15,000 B.P. to 1650 A.D.
A.R.H.

N81-13449# Harvard Univ., Cambridge, Mass. Inst. for Conservation Archaeology.
A SUMMARY AND ANALYSIS OF CULTURAL RESOURCE INFORMATION ON THE CONTINENTAL SHELF FROM THE BAY OF FUNDY TO CAPE HATTERAS. VOLUME 2: ARCHAEOLOGY AND PALEONTOLOGY Final Report
Russell Barber 1979 445 p refs 4 Vol.
(Contract DI-AA551-CT8-18)
(PB80-220122; ICA-88-Vol-2; BLM/YL/SR-79/02-Vol-2) Avail: NTIS HC A19/MF A01 CSCL 13B
A model is presented for predicting the nature and distribution of prehistoric sites on present land and on the continental shelf of North American from Maine to North Carolina. The known inventory of sites, the theory of optimal foraging strategy, environmental reconstruction, and paleoclimatology were used as information sources for the model.
A.R.H.

N81-13450# Harvard Univ., Cambridge, Mass. Inst. for Conservation Archaeology.
A SUMMARY AND ANALYSIS OF CULTURAL RESOURCE INFORMATION ON THE CONTINENTAL SHELF FROM THE BAY OF FUNDY TO CAPE HATTERAS. VOLUME 3: HISTORIC SHIPPING Final Report
Bruce Bourque 1979 150 p refs 4 Vol.
(PB80-220130; ICA-88-Vol-3; BLM/YL/SR-79/03-Vol-3) Avail: NTIS HC A07/MF A01 CSCL 13B
A predictive modeling process is described for identifying those areas which have a probability for containing sunken ships classified as significant cultural resources. Various approaches were used depending on the type and quality of data available for the following periods: pre-1630; 1630 to 1880; 1800 to 1880; and 1880 to 1945.
A.R.H.

N81-13451# Harvard Univ., Cambridge, Mass. Inst. for Conservation Archaeology.
A SUMMARY AND ANALYSIS OF CULTURAL RESOURCE INFORMATION ON THE CONTINENTAL SHELF FROM THE BAY OF FUNDY TO CAPE HATTERAS. VOLUME 4: MANAGEMENT Final Report
Michael E. Roberts 1979 387 p refs 4 Vol.
(Contract DI-AA551-CT8-18)
(PB80-220148; ICA-88-Vol-4; BLM/YL/SR-79/04-Vol-4) Avail: NTIS HC A17/MF A01 CSCL 13B
The late Quaternary geology of the U.S. Continental Shelf from New England to North Carolina was reviewed as it relates to cultural resources in an effort to provide guidelines for land users and those having jurisdiction over lands on abutting the Continental Shelf. Specific approaches to cultural resource management are recommended to minimize the impact upon resources of the many types of activities taking place within the study area. The recommendations include initiating locational surveys, developing public education programs, identifying impacts to resources in environmental impact assessments, advising federal agencies on the types of expected impacts to archaeological properties, evaluating the effects of chemical dumping, and specifying the general levels of survey that will be required in the various stages of oil and gas development.
A.R.H.

N81-13452# Metrics, Inc., Atlanta, Ga.
OVERVIEW OF CONFERENCE WITH NON-FEDERAL USERS ON US OPERATIONAL LAND REMOTE SENSING SATELLITE PROGRAM
Apr. 1980 100 p Conf. held in Seattle, 14 Mar. 1980; in Chicago, 17 Mar. 1980; in Tallahassee, 21 Mar. 1980; in Washington, D.C., 25 Mar. 1980; and in Albuquerque, N. Mex., 28 Mar. 1980 Sponsored by NOAA
(PB80-219736; NOAA-80071501) Avail: NTIS HC A05/MF A01 CSCL 04B
The decision process leading up to Presidential Directive NSC/54, the operational role that NOAA/NESS has had with regard to weather satellites, and the history of NASA's Landsat program were reviewed. The role of NOAA as the management agency for all operational civil remote sensing satellite programs is examined as well as and the planning process which will enable NOAA to take responsibility for the operational land remote sensing satellite program later in this decade. The results from 15 user working group indicate that NOAA's perception of user needs was generally correct; that spatial resolution requirements are grouped into three categories (i.e., 10, 30, 40, and 80 meters) and that the current MSS and TM bands satisfy most spectral requirements in the visible and solar infrared regions of the spectrum. Additionally, the groups recommended that: (1) the private sector have some formal input to NOAA's planning process; (2) technology transfer and training activities should continue; (3) data should be archived as long as possible; and (4) a quick look capability is essential for an operational system.
GRA

N81-13453# Idaho Univ., Moscow. Water Resources Research Inst.
SEASONAL WATER SUPPLY FORECASTING FOR AREAS HAVING SEASONAL SNOWCOVER
T. B. Cline Mar. 1980 128 p refs
(PB80-207160; W80-05808; OWRT-A-065-IDA(1)) Avail: NTIS HC A07/MF A01 CSCL 13B
An iterative three stage process model for forecasting seasonal runoff volume in basins subject to seasonal snowcover was developed as a tool for effective watershed management. More accurate water supply forecasts are valuable in power production,

flood control, and agriculture. The model captures the essential cyclical charater of streamflow dynamics in basins such as those in the Pacific Northwest. The model also has provisions for the effects of random weather and runoff fluctuations. GRA

N81-13454# National Geodetic Survey, Rockville, Md.
REVISIONS OF THE HOACOS HEIGHT-CONTROLLED NETWORK ADJUSTMENT PROGRAM
T. Vincenty May 1980 9 p refs
(PB80-223324; NOAA-TM-NOS-NGS-25) Avail: NTIS HC A02/MF A01 CSCL 08E

Experience with this program disclosed the need for certain revisions to make it more general to application. These revisions are described. They include the adjustment in the geodetic horizon system, a change of units for compatibility with other programs, a revised method of treating the direction of gravity at stations with no astronomic data, and the handling of observations when some heights are not given. GRA

N81-13455# National Geodetic Survey, Rockville, Md.
APPLICATION OF SPECIAL VARIANCE ESTIMATORS TO GEODESY
John D. Bossler and Robert H. Hanson Feb. 1980 16 p refs
(PB80-223332; NOAA-TR-NOS-84-NGS-15; NOAA-80070702)
Avail: NTIS HC A02/MF A01 CSCL 08E

One important estimator required the computation of noninteger degrees of freedom. An analysis was performed on the results obtained from constraining the coordinates of peripheral network stations by a priori variances. GRA

N81-13456 California Univ., Davis.
SOIL-LAND FORM RELATIONSHIPS OF PORTIONS OF THE SAN JOAQUIN RIVER AND KINGS RIVER ALLUVIAL DEPOSITIONAL SYSTEMS IN THE GREAT VALLEY OF CALIFORNIA Ph.D. Thesis
Gordon Leland Huntington 1980 261 p
Avail: Univ. Microfilms Order No. 8027058

Using existing information gathered during the Eastern Fresno Area soil survey, and from adjoining areas, the systems of nested alluvial fans of both the San Joaquin and Kings Rivers were investigated. Analysis of two extremely old land forms and their soils, near the canyon mouth of the Kings River, suggests these to be correlative with the surfaces of the China Hat gravels (Upper Pliocene?) of the Laguna formation, and the somewhat younger North Merced gravels in Merced County, California. Erosional remnants of gravelly material and their soils, near the canyon mouth of the San Joaquin River, also suggest a similar relationship, but less clearly. In the northern part of the study area, relating certain marker soils to eroded upland terrain in comparison to dated Pliocene volcanic flows and associated fill of ancestral channels of the San Joaquin River provides a limited indication of the nature and development of local mid and early Tertiary landscapes. Dissert. Abstr.

N81-13457 Arizona State Univ., Tempe.
MESOSCALE RELATIONSHIPS OF TALUS AND INSOLATION, SAN JUAN MOUNTAINS, COLORADO Ph.D. Thesis
Albert D. Hyers 1980 255 p
Avail: Univ. Microfilms Order No. 8027646

Talus properties in the western San Juan Mountains of Colorado vary systematically with elevation and insolation. This conclusion is based on data collected at 79 small rockfall sites having various elevations and orientations, primarily within three volcanic rock formations. Talus properties for all sites consisted of the lengths of each of the three pincipal axes of 60 randomly selected fragments; relationships among these axes were used to obtain arithmetic and geometric mean axes, a volume surrogate, and three shape parameters: fragment elongation ratio, sphericity and flatness indices. Site attributes consisted of elevation, cliff slope angle, fracture density of the source cliff and sky horizon data. All statistical procedures show that talus axes lengthen significantly as (1) fractures become more widely spaced; (2) elevation increases; (3) orientation becomes more northerly; (4) more of the southern sky is blocked by topography; and (5) July, or summer, insolation totals decrease. Dissert. Abstr.

N81-13458 New Hampshire Univ., Durham.
THE VERTICAL STRUCTURE OF ESTUARINE TIDAL CURRENTS Ph.D. Thesis
Ronnal Paul Reichard 1980 123 p
Avail: Univ. Microfilms Order No. 8027797

The surface slope induced pressure gradient, mean current velocity profile, and bottom stress are investigated both theoretically and experimentally for a tidal channel in a well-mixed estuary. The theory focuses on the use of eddy viscosity models. Surface slope estimates based on tide predictions, current velocity profile measurements, and stress estimates from near bottom turbulence measurements are used to investigate the dynamic balance in the tidal channel, and to evaluate the eddy viscosity models. Two lower boundary conditions were investigated: the usual no-slip condition, and a near bottom stress condition. The current velocity solution of the eddy viscosity model, using the latter boundary condition, is a linear function of bottom stress and surface slope. Thus, instead of specifying surface slope and the stress boundary condition to predict current velocity, the equations are rearranged to predict surface slope and bottom stress for a least squares fit to current velocity profile data. This procedure, called the Extended Profile Method, can be used to predict bottom stress and surface slope to first order accuracy. Dissert. Abstr.

N81-13390# Food and Agriculture Organization of the United Nations, Rome (Italy). Centre de Teledetection.
GENERAL VIEW OF REMOTE SENSING APPLICATIONS IN AGROCLIMATOLOGY AND AGROMETEOROLOGY [VUE GENERALE DE L'EMPLOI DE LA TELEDETECTION DANS L'AGROCLIMATOLOGIE ET L'AGROMETEOROLOGIE]
John A. Howard *In* ESA Satellite Remote Sensing Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 5-9 In FRENCH (For primary document see N81-13388 04-42)
Avail: NTIS HC A07/MF A01

N81-13392# Institut National de la Recherche Agronomique, Paris (France).
THE APPLICATIONS OF REMOTE SENSING TO AGRICULTURE [APPLICATIONS DE LA TELEDETECTION A L'AGRICULTURE]
C. C. Goillot *In* ESA Satellite Remote Sensing Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 17-26 refs In FRENCH (For primary document see N81-13388 04-42)
Avail: NTIS HC A07/MF A01

N81-13393# Institut National de la Recherche Agronomique, Avignon (France). Station de Bioclimatologie.
APPLICATIONS OF REMOTE SENSING IN THE INFRARED TO THE DETERMINATION OF THE EVAPORATION AND THE HUMIDITY OF SOIL [APPLICATION DE LA TELEDETECTION DANS L'INFRAROUGE THERMIQUE A LA DETERMINATION DE L'EVAPORATION ET DE L'HUMIDITE DU SOL]
B. Seguin *In* ESA Satellite Remote Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 27-37 refs In FRENCH (For primary document see N81-13388 04-42)
Avail: NTIS HC A07/MF A01

N81-13395# European Space Agency, Paris (France). Dept. des Applications Futures.
THE EUROPEAN REMOTE SENSING PROGRAM [LE PROGRAMME EUROPEEN DE TELEDETECTION]
G. Duchossois *In its* Satellite Remote Sensing Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 53-63 refs In FRENCH (For primary document see N81-13388 04-42)
Avail: NTIS HC A07/MF A01

N81-13398# Centre National d'Etudes Spatiales, Toulouse (France).
RADIOMETRIC PROBLEMS IN AGRICULTURAL REMOTE SENSING [PROBLEMES RADIOMETRIQUES EN TELEDETECTION AGRICOLE]
G. Saint *In* ESA Satellite Remote Sensing Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 87-99 In FRENCH (For primary document see N81-13388 04-42)
Avail: NTIS HC A07/MF A01

N81-13399# Centre National d'Etudes Spatiales, Toulouse (France).

SPOT: PROBE SYSTEM FOR EARTH OBSERVATION [SPOT: SYSTEME PROBATOIRE A'OBSERVATION DE LA TERRE]
M. Cazenave *In* ESA Satellite Remote Sensing Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 101-103 In FRENCH (For primary document see N81-13388 04-42)
Avail: NTIS HC A07/MF A01

N81-13400# Food and Agriculture Organization of the United Nations, Rome (Italy).
CROP SURVEILLANCE BASED ON AGROMETEOROLOGICAL DATA [SURVEILLANCE DES CULTURES BASEE SUR DES INFORMATIONS AGROMETEOROLOGIQUES]
G. F. Popov *In* ESA Satellite Remote Sensing Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 105-113 In FRENCH (For primary document see N81-13388 04-42)
Avail: NTIS HC A07/MF A01

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N81-13459 Clark Univ., Worcester, Mass.
RESIDENTIAL SOLAR ENERGY USE: A COMPARATIVE ASSESSMENT OF SOLAR CONSUMERS AND THE SOLAR RESEARCH COMMUNITY Ph.D. Thesis
Stephen Weld Sawyer 1980 269 p
Avail: Univ. Microfilms Order No. 8027967

An accurate and sensitive evaluation of the barriers and incentives to the use of solar energy systems is presented. This was achieved by determining how they are assessed by present solar consumers and by comparing these assessments to those of the solar research community. The consumers' motivations, attitudes, and economic and technical assessments were also determined and compared to the scientists' perceptions of these topics. In addition, the two populations' perspectives of the barriers, incentives and other issues related to the widespread adoption of solar systems were ascertained. The survey results are augmented by the public policy implications of the research findings. Dissert. Abstr.

N81-13460 Clarkson Coll. of Technology, Potsdam, N.Y.
A STUDY OF THIN-FILM POLYCRYSTALLINE CADMIUM SULPHIDE-COPPER SULPHIDE (u2S/CdS) SOLAR CELLS AND COPPER SULPHIDE (Cu2S) Ph.D. Thesis
Lawrence Vincent Hmurcik 1981 244 p
Avail: Univ. Microfilms Order No. 8028437

The effects of heat treatment on three CuxS thin films were studied. Initial heat treatments caused copper in grain boundaries to diffuse irreversibly into the CuxS crystallites. Subsequent heating in hydrogen caused reduction in surface oxides while the reverse process occurred in an oxygen atmosphere. At a given elevated temperature (usually 150 C) the resistivity (p) and charge density (P) vary with time. On the other hand, the mobility is found to be approximately constant at a given temperature. Changes in CuxS stoichiometry were correlated with the sheet resistance of the CuxS layer in completed cells. Heat treatment in a hydrogen atmosphere caused an increase in resistivity (corresponding to an increase in stoichiometry) while oxygen caused the reverse. The effects of hydrogen heat treatments are reported on CdS/CuxS polycrystalline thin film solar cells. Measurements of the dark capacitance of CdS cells as a function of the frequency of the applied signal voltage showed that the capacitance varies with frequency. Dissert. Abstr.

N81-13461*# La Quinta Motor Inns, Inc., San Antonio, Tex.
SOLAR HOT WATER SYSTEM INSTALLED AT MOBILE, ALABAMA Final Report
Oct. 1980 28 p refs Sponsored by NASA
(Grant DOE-77-G-01-1623)
(NASA-CR-161587) Avail: NTIS HC A03/MF A01 CSCL 10A

The system consists of six rows of ten collectors and three rows of eleven collectors (1990 square feet) mounted on the roof. Griswald flow control valves were installed to regulate the flow to each row. Two Heliotrope electronic thermometers with a combined capability of measuring the temperatures of 22 different locations were installed for monitoring purposes. Author

N81-13462*# Spectrolab, Inc., Sylmar, Calif.
INVESTIGATION OF PROPOSED PROCESS SEQUENCE FOR THE ARRAY AUTOMATED ASSEMBLY TASK, PHASES 1 AND 2 Final Report, 1 Oct. 1977 - 30 Jun. 1980
Nick Mardesich, Alec Garcia, and Kim Eskenas Aug. 1980 484 p refs Sponsored in part by DOE Prepared for JPL
(Contract JPL-954853)
(NASA-CR-163813; JPL-954853-80/10; JPL-9950-441) Avail: NTIS HC A21/MF A01 CSCL 01A

Progress was made on the process sequence for module fabrication. A shift from bonding with a conformal coating to laminating with ethylene vinyl acetate and a glass superstrate is recommended for further module fabrication. The processes that were retained for the selected process sequence, spin-on diffusion, print and fire aluminum p+ back, clean, print and fire silver front contact and apply tin pad to aluminum back, were evaluated for their cost contribution. A.R.H.

N81-13463*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DATA ACQUISITION AND ANALYSIS IN THE DOE/NASA WIND ENERGY PROGRAM
Harold E. Neustadter 1980 18 p refs Presented at Symp. on Detection Diagnosis and Prognosis, Santa Monica, Calif., 7-9 Oct. 1080; sponsored by NBS
(Contract EX-76-I-01-1028)
(NASA-TM-81603; E-594) Avail: NTIS HC A02/MF A01 CSCL 10B

Four categories of data systems, each responding to a distinct information need are presented. The categories are: control, technology, engineering and performance. The focus is on the technology data system which consists of the following elements: sensors which measure critical parameters such as wind speed and direction, output power, blade loads and strains, and tower vibrations; remote multiplexing units (RMU) mounted on each wind turbine which frequency modulate, multiplex and transmit sensor outputs; the instrumentation available to record, process and display these signals; and centralized computer analysis of data. The RMU characteristics and multiplexing techniques are presented. Data processing is illustrated by following a typical signal through instruments such as the analog tape recorder, analog to digital converter, data compressor, digital tape rocorder, video (CRT) display, and strip chart recorder. Author

N81-13464*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STATUS OF COMMERCIAL PHOSPHORIC ACID FUEL CELL SYSTEM DEVELOPMENT
Marvin Warshay, Paul R. Prokopius, Steven N. Simons, and Robert B. King 1981 12 p refs Proposed for presentation at 19th Aerospace Sci. Meeting, St. Louis, 12-15 Jan. 1981; sponsored by AIAA
(Contract DE-AI03-79ET-11272)
(NASA-TM-81641; E-659; DOE/NASA/11272-2) Avail: NTIS HC A02/MF A01 CSCL 10A

In both the electric utility and onsite integrated energy system applications, reducing cost and increasing reliability are the main technology drivers. The longstanding barrier to the attainment of these goals, which manifests itself in a number of ways, was materials. The differences in approach among the three major participants (United Technologies Corporation, Westinghouse Electric Corporation/Energy Research Corporation, and Engelhard Industries) and their unique technological features, including electrodes, matrices, intercell cooling, bipolar/separator plates,

electrolyte management, fuel selection and system design philosophy are discussed. Author

N81-13465*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
IGNITION OF LEAN FUEL-AIR MIXTURES IN A PREMIXING-PREVAPORIZING DUCT AT TEMPERATURES UP TO 1000 K
Robert R. Tacina Dec. 1980 16 p refs
(Contract DE-AI01-77CS-51040)
(NASA-TM-81645; E-9356-3; DOE/NASA/51040-19) Avail: NTIS HC A02/MF A01 CSCL 21B

Conditions were determined in a premixing prevaporizing fuel preparation duct at which ignition occurred. An air blast type fuel injector with nineteen fuel injection points was used to provide a uniform spatial fuel air mixture. The range of inlet conditions where ignition occurred were: inlet air temperatures of 600 to 1000 K air pressures of 180 to 660 kPa, equivalence ratios (fuel air ratio divided by stoichiometric fuel air ratio) from 0.12 to 1.05, and velocities from 3.5 to 30 m/s. The duct was insulated and the diameter was 12 cm. Mixing lengths were varied from 16.5 to 47.6 and residence times ranged from 4.6 to 107 ms. The fuel was no. 2 diesel. Results show a strong effect of equivalence ratio, pressure and temperature on the conditions where ignition occurred. The data did not fit the most commonly used model of auto-ignition. A correlation of the conditions where ignition would occur which apply to this test apparatus over the conditions tested is (p/V) phi to the 1.3 power = 0.62 e to the 2804/T power where p is the pressure in kPa, V is the velocity in m/e, phi is the equivalence ratio, and T is the temperature in K. The data scatter was considerable, varying by a maximum value of 5 at a given temperature and equivalence ratio. There was wide spread in the autoignition data contained in the references. A.R.H.

N81-13466*# Burns and Roe, Inc., Woodbury, N. Y.
ENGINEERING SUPPORT FOR MAGNETOHYDRODYNAMIC POWER PLANT ANALYSIS AND DESIGN STUDIES
A. W. Carlson, I. L. Chait, G. Marchmont, R. Rogali, and D. Shikar Aug. 1980 288 p refs
(Contracts DEN3-107; EC-77-A-01-2674)
(NASA-CR-159690; DOE/NASA/0197-1) Avail: NTIS HC A13/MF A01 CSCL 10B

The major factors which influence the economic engineering selection of stack inlet temperatures in combined cycle MHD powerplants are identified and the range of suitable stack inlet temperatures under typical operating conditions is indicated. Engineering data and cost estimates are provided for four separately fired high temperature air heater (HTAH) system designs for HTAH system thermal capacity levels of 100, 250, 500 and 1000 MWt. An engineering survey of coal drying and pulverizing equipment for MHD powerplant appiication is presented as well as capital and operating cost estimates for varying degrees of coal pulverization. A.R.H.

N81-13467*# Burns and Roe, Inc., Woodbury, N. Y.
MODIFICATION OF THE ECAS REFERENCE STEAM POWER GENERATING PLANT TO COMPLY WITH THE EPA 1979 NEW SOURCE PERFORMANCE STANDARDS Final Report
S. A. Fogelson, I. L. Chait, W. J. Bradley, and W. Benson Aug. 1980 246 p refs
(Contracts DEN3-107; DE-AI01-77ET-10769)
(NASA-CR-159853; DOE/NASA/0107-2) Avail: NTIS HC A11/MF A01 CSCL 10B

Detailed capital cost estimates for the ECAS and modified reference plants in mid-1978 dollars for both 250 and 175 F (394 and 353 K) stack gas reheat temperatures based on the cost estimates developed for the ECAS study are presented. The scope of the work included technical assessment of sulfur dioxide scrubber system design, on site calcination versus purchased lime, reheat of stack gas, effect of sulfur dioxide scrubber on particulate emission, and control of nitrogen oxides. Author

N81-13468# Committee on Science and Technology (U. S. House).
OVERSIGHT: ENERGY SUPPLY AND DEMAND FORECASTS, VOLUME 4
Washington GPO 1979 646 p refs Hearings before the Subcomm. on Energy Develop. and Appl. of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., no. 19, 23-24 May 1979 (GPO-47-986) Avail: SOD HC

The Department of Energy presents a forecast of United States energy supply and demand up to the year 2000. Particular attention is given to the use of mathematical models in making the forecast. World oil prices, domestic coal use, domestic nuclear capacity, and growth in domestic energy demand are discussed in detail. L.F.M.

N81-13469*# Raytheon Co., Wayland, Mass. Advanced Development Lab.
SOLID STATE SPS MICROWAVE GENERATION AND TRANSMISSION STUDY. VOLUME 2, PHASE 2: APPENDICES Final Report
Owen E. Maynard Washington NASA Nov. 1980 115 p refs
(Contract NAS8-33157)
(NASA-CR-3339; ER80-4074-2) Avail: NTIS HC A06/MF A01 CSCL 10A

The solid state sandwich concept for SPS was further defined. The design effort concentrated on the spacetenna, but did include some system analysis for parametric comparison reasons. Basic solid state microwave devices were defined and modeled. An initial conceptual subsystems and system design was performed as well as sidelobe control and system selection. The selected system concept and parametric solid state microwave power transmission system data were assessed relevant to the SPS concept. Although device efficiency was not a goal, the sensitivities to design of this efficiency were parametrically treated. Sidelobe control consisted of various single step tapers, multistep tapers and Gaussian tapers. A hybrid concept using tubes and solid state was evaluated. Thermal analyses are included with emphasis on sensitivities to waste heat radiator form factor, emissivity, absorptivity, amplifier efficiency, material and junction temperature. A.R.H.

N81-13470# Committee on Science and Technology (U. S. House).
OVERSIGHT: BIOMASS
Washington GPO 1980 178 p refs Hearing before the Subcomm. on Energy Develop. and Appl. of the Comm. on Sci. and Technol., 96th Congr., 2nd Sess., no. 116, 10 Mar. 1980 (GPO-63-224) Avail: Subcommittee on Energy Development and Applications

The use of the biomass as a renewable energy source is discussed in detail. Estimates of what percentage of our future energy needs can be supplied by biomass are presented and recommendations are made for additional research needed for optimum biomass energy conversion. L.F.M.

N81-13471# Aeronautical Research Inst. of Sweden, Stockholm.
THE VELOCITY INDUCED BY THE WAKE OF A WIND TURBINE IN A SHEAR LAYER, INCLUDING GROUND EFFECT
Bo C. A. Johansson Jun. 1980 41 p
(FFA-133) Avail: NTIS HC A03/MF A01

A theory was developed for the calculation of the velocity field induced by the wake of a horizontal axis wind turbine in a wind shear layer and in the vicinity of a plane ground surface, when the force distribution of the turbine is known. The turbine was approximated by a disk area of continuous distributions of thrust and force parallel to the disk plane. Its wake was represented by a semi-infinite cylinder of distributed vorticity. A numerical example was calculated. The theory was based upon assumptions strictly valid only for small perturbations of the undisturbed flow. R.C.T.

N81-13472# Sandia Labs., Albuquerque, N. Mex.
LOW COST PHOTOVOLTAIC CONCENTRATOR ARRAY: A NOVEL DESIGN UTILIZING GLASS-REINFORCED CONCRETE
J. R. Taylor Jun. 1980 272 p refs
(Contract DE-AC04-76DP-00789)
(SAND-79-7053) Avail: NTIS HC A12/MF A01

A prototype of a low cost photovoltaic concentrator array

was designed and built. This array features the development of a two axis tracking system which is designed to support high concentration point focus collectors (up to 400 suns). In addition to the cost advantages of reducing the expensive cell area in a high concentration Fresnel lens collector system, this array consists primarily of spray molded glass reinforced concrete (GRC) as the low cost structural material that most advantageously meets system rigidity requirements. The prototype array is designed to meet all guidelines for operational lifetime, operating temperature, degradation under wind loading and environmental hazards for any location in the continental United States. The prototype drive system can handle collector modules at concentrations of over 400 suns. DOE

N81-13473# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

EXPERIMENTAL STUDY OF THE THERMAL PERFORMANCE PARAMETERS OF A LIQUID HEATING FLAT PLATE SOLAR COLLECTOR M.S. Thesis

Charles Dana Woodrum Sep. 1980 122 p refs
(AD-A091085; AFIT/GAE/AA/80S-3) Avail: NTIS HC A06/MF A01 CSCL 10/1

From the results of this investigaiton the following conclusions are drawn: (1) the use of turbulators greatly enhanced the internal heat transfer coefficient, but unfortunately, made little difference in the overall performance; (2) the use of turbulators improved flow uniformity by increasing the pressure drop in the tubes; (3) the diameter of the headers should be larger to help ensure flow uniformity. This is especially true for low flowrate conditions such as those tested; (4) the bond conductance for the clamped fin was competitive with soldering since little gain in performance is realized after a value of 20 B/hr-ft-F is achieved; (5) the bond conductance of the woven fin configuration was unacceptable; and (6) Kalwall material was essentially opaque to far infrared radiation. GRA

N81-13474# Sandia Labs., Albuquerque, N. Mex. Exploratory Batteries Div.

PERFORMANCE DATA FOR A LITHIUM-SILICON/IRON DISULFIDE, LONG-LIFE, PRIMARY THERMAL BATTERY

Rod K. Quinn, Arlen R. Baldwin, and James R. Armijo Jun. 1980 19 p refs
(Contract DE-AC04-76DP-00789)
(SAND-79-2148) Avail: NTIS HC A02/MF A01

A 60 minute, 28 volt, 0.5 ampere, primary thermal battery with a volume of 400 cu cm was developed in the Li(Si)/LiC1. KC1/FeS2 electrochemical system. The effects of various simulated environmental tests on the performance of this battery are described. Author

N81-13475# Sandia Labs., Albuquerque, N. Mex.

THE EFFECT OF DIFFUSION ON THE PHOTOCONDUCTIVITY OF THIN FILMS

R. C. Hughes and R. J. Sokel 1980 9 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-0395C; CONF-80047-6) Avail: NTIS HC A02/MF A01

The equations governing time dependent and steady state photoconductivity are solved analytically for some approximations and numerically in exact form. The diffusion terms are shown to be important especially in thin films. Some data of Farmer and Lee on photoconductivity in MOS structures is reinterpreted with losses due to diffusion to the contacts included. Author

N81-13476# Sandia Labs., Albuquerque, N. Mex.

PROTECTIVE COATINGS AND SEALANTS FOR SOLAR APPLICATIONS

K. B. Wischmann and N. H. Gonzales Sep. 1980 46 p refs Sponsored by DOE
(SAND-80-0808) Avail: NTIS HC A03/MF A01

An aging study was completed which evaluated a number of polymeric materials for potential use as (1) protective coatings for back surfaces of mirrors and (2) solar heliostat edge seals. These investigations were conducted in an artificial weathering chamber that accelerated thermal cycling. The primary mirror failure mode was observed to be silver corrosion resulting from moisture exposure. To increase mirror longevity in current heliostat designs, intimate bonding at all the composite interfaces is essential to minimize moisture pathways to the silvered surface. If any voids or delaminations are present, mirror degradation will eventually occur. Delaminations can also occur as the result of mechanical stresses brought about by mismatches in the various materials coefficients of thermal expansion. If good bonding cannot be achieved or mechanical stresses avoided, then improved moisture barriers must be designed to assure mirror longevity. Author

N81-13477 FAFCO, Inc., Menlo Park, Calif.

COAXIAL EXTRUSION CONVERSION CONCEPT FOR POLYMERIC FLAT PLATE SOLAR COLLECTORS Final Technical Report, 30 Sep. 1978 - 31 Dec. 1979

Richard O. Rhodes, Nicholas J. Chapman, Kwang C. Chao, and Kenneth F. Sorenson Jan. 1980 221 p refs
(Contracts DE-AC03-78CS-32241; EM-78-C-03-3341)
(DOE/CS-32241/1) HC A10/MF A01

Materials and processes for fundamental improvements in flat plate solar collector cost and performance were investigated. The feasibility of a cost effective, glazed solar collector, with low labor input, utilizing a coaxial extrusion of compatible polymeric materials was studied. All considered materials for the desired application was evaluated. In addition, there was a trial extrusion of the leading candidate glazing and absorber materials, which resulted in successfully performing a coaxial extrusion of one cell. At the time the study was conducted, there were no materials available that met the necessary requirements for the specified utilization. It was recommended that, if potentially compatible materials become available, further investigation into the suitability of those materials be researched. DOE

N81-13478# Arizona State Univ., Tempe. Dept. of Mechanical Engineering.

SIMULATION AND SIMPLIFIED DESIGN STUDIES OF PHOTOVOLTAIC SYSTEMS

D. L. Evans, W. A. Facinelli, and L. P. Koehler 1980 180 p refs
(SAND-80-7013) Avail: NTIS HC A09/MF A01

Results of simulations of photovoltaic systems with electrical storage are described. Studies of the sensitivity of system performance, in terms of the fraction of the electrical load supplied by the solar energy system, to variables such as array size, battery size, location, time of year, and load shape are reported. An accurate simplified method for predicting array output of man power photovoltaic systems is presented. A second simplified method which estimates the overall performance of man power systems is developed. Finally, a preliminary technique for predicting clumped voltage system performance is discussed. Author

N81-13479# Spectrolab, Inc., Sylmar, Calif.

NEAR-TERM IMPLEMENTATION OF PRODUCTION COST REDUCTIONS FOR PHOTOVOLTAIC CONCENTRATOR ARRAYS

Ivan Lawrence Aug. 1980 37 p Sponsored by DOE
(SAND-80-7071) Avail: NTIS HC A03/MF A01

A process sequence for the fabrication of concentrator solar cells from raw silicon wafers is described. The innovation utilized in this process sequence consists of fabricating thick film conductive ink front contacts by utilizing solid photoresist as a mask. This approach overcomes the relatively poor line width resolution (approximately 5 mils) characteristic of conventional screen printing technology, while retaining the cost advantages of this technique. In this way, the premium performance characteristics of evaporated metal front contacts are combined with the low cost and high production capabilities of thick film materials and techniques. Author

N81-13480# Indian Inst. of Management, Ahmedabad.

RESEARCH PLANNING WORKSHOP ON ENERGY FOR RURAL DEVELOPMENT

1979 264 p refs Workshop held at Ahmedabad, India, 27-29 Dec. 1979 Sponsored in part by Tata Energy Research Inst., Jyoti Solar Energy Inst., Jyoti Ltd., and Dept. of Science and Technology
(CONF-791251) Avail: NTIS (US Sales Only) HC A12/MF A01; DOE Depository Libraries

An integrated need based research and implementation program consisting of projects for energy supply in rural areas of India, with emphasis on renewable sources which can be implemented in 2 to 3 years is described. Papers are presented on the following: Rural Energy Demand Supply Data Base Development; Introduction to New and Renewable Energy Technologies in Rural Energy Mix; Fuel Plantation for Rural Areas; Techno-Economic Analysis of Rural Energy Systems; and Energy Policy for Rural Areas and Development Strategy. DOE

N81-13481# Hauptberatungsstelle fuer Elektrizitaetsanwendung e.V., Frankfurt am Main (West Germany).
ELECTRIC POWER REPLACING OIL: THE DEVELOPMENT OF HOT WATER SUPPLIES TO PRIVATE HOUSEHOLDS IN THE FEDERAL REPUBLIC OF GERMANY
Oct. 1979 12 p refs In GERMAN
(NP-25125) Avail: NTIS (US Sales Only) HC A02/MF A01; DOE Depository Libraries

Generally available statistics and analyses were the basis as well as a market enquiry covering 35,000 households, the evaluation of which was conducted in 1979. This material clearly shows that 27% of the total final energy consumption in the FRG go to the consumption area household, out of which 9% - corresponding to 2.4% of the total needs of final energy - go to hot water supplies. At first glance, this figure seems small. However, households use as much energy as, e.g., the total traffic of rail, ship and air in the FRG. DOE

N81-13482# Telic Corp., Santa Monica, Calif.
CADMIUM SULFIDE/COPPER SULFIDE HETEROJUNCTION CELL RESEARCH Final Report, 26 Feb. 1979 - 15 Jul. 1980
John A. Thornton and David G. Cornog 30 Jun. 1980 70 p refs
(Contract DE-AC02-77CH-00178)
(SERI/TR-8033-2-T1) Avail: NTIS HC A04/MF A01

Extensive modifications were made to the multi-source deposition apparatus. These include the installation of a larger vacuum chamber on the existing system. The new chamber provides improved inter-source shielding, an improved substrate mounting and heating system, and a vacuum interlock for introducing substrates. CdS resistivity control by both In doping and off-stoichiometric deposition was investigated. Indium doping was achieved both by diffusion from a pre-deposited In layer and by using In doped sputtering targets. Resistivities were found to be critically dependent on the H2S injection rate, apparently because of compensation by Cd vacancies. The Cu/sub x/S deposition process was found to be sensitive to the period of cathode operation prior to coating deposition, probably because of the conditioning of cathode and shield surfaces. DOE

N81-13483# General Electric Co., Schenectady, N. Y. Dept. of Energy Systems Programs.
ELECTRIC POWER GENERATING SUBSYSTEM STUDY FOR ADVANCED WATER/STEAM RECEIVERS Final Technical Report
G. Oganowski and D. J. Muller Apr. 1980 176 p Sponsored by DOE
(SAND-80-8180) Avail: NTIS HC A09/MF A01

The performance and economics of a range of 1985 vintage Rankine power conversion cycles for advanced water/steam solar plant application were evaluated. Sufficient information is provided for the selection of the optimum power conversion cycle when integrated with other advanced water/steam solar plant systems being developed. L.F.M.

N81-13484# Exide Management and Technology Co., Yardley, Pa.
RESEARCH, DEVELOPMENT AND DEMONSTRATION OF NICKEL-ZINC BATTERIES FOR ELECTRIC VEHICLE PROPULSION Annual Report, 1979
Jun. 1980 110 p refs
(Contract W-31-109-eng-38)
(ANL/OEPM-79-12) Avail: NTIS HC A06/MF A01

Activities in a program to develop a nickel zinc battery for electric vehicle propulsion are reported. Aspects discussed include battery design and development, nickel cathode study, and basic electrochemistry. A number of engineering drawings are supplied. DOE

N81-13485# Sperry Univac, St. Paul, Minn.
CADMIUM SULFIDE/COPPER TERNARY HETEROJUNCTION CELL RESEARCH Final Report, 8 Jan. 1979 - 7 Jun. 1980
D. L. Fleming 1980 29 p refs
(Contract DE-AC02-77CH-00178)
(SERI/TR-8010-1-T1) Avail: NTIS HC A03/MF A01

Dual source, Se and CuInSe2, coevaporation and flash evaporation of stoichiometric CuInSe2 powder were investigated to develop a process of fabricating large area CdS/CuInSe2, heterojunction solar cells. CuInSe2 was decomposed upon evaporation, producing layered films in the dual source system. Annealing of these films and alternative dual sources were considered. Single phase p type films were produced but no devices were made from such films. Flash evaporation circumvents the decomposition problem, and if the powder is baked to obtain a small Cu excess as well as getting a Se excess in the film, p type CuInSe2 films can be obtained. Annealing studies and measurements of spatial uniformity of this device are reported. DOE

N81-13486# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
OPEN WORKSHOP ON SOLAR TECHNOLOGIES: PROCEEDINGS
Jul. 1980 231 p Workshop held in Washington, D.C., 23-24 Oct. 1979
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/CP-741-683; CONF-7910187) Avail: NTIS HC A11/MF A01

The deliberations, conclusions, and recommendations of six panels asked to provide advice to the Department of Energy on the subject of solar energy are detailed. Introductory speeches by seven experts, excerpts from the succeeding two half days of discussion, the final reports for the panel chairpersons, and subsequent discussion and questioning are included. Approximately 125 findings and recommendations were developed by the six panels covering a wide variety of topics. Major recurring themes were recommendations for increased funding, federal program improvement, conservation, outreach programs small business funding, and solar training programs. DOE

N81-13487# National Bureau of Standards, Washington, D.C. Center for Building Technology.
LIFE-CYCLE COSTING: A GUIDE FOR SELECTING ENERGY-CONSERVATION PROJECTS FOR PUBLIC BUILDINGS
Rosalie T. Ruegg, John S. McConnaughey, G. Thomas Sav, and Kimberly A. Hockenbery Sep. 1978 84 p refs
(Contract DE-AT01-77CS-26010)
(NBS-BSS-113) Avail: NTIS HC A05/MF A01

A step by step guide is provided for conducting life cycle cost evaluations of energy conservation projects for public buildings. The use of life cycle costing analysis to evaluate and rank the cost effectiveness of alternative energy conservation retrofit projects to existing public buildings, and to select the most cost effective design for new buildings is explained. Worksheets, illustrated with a realistic example, and a computer program are included. This guide is compatible with a life cycle costing guide prepared for DOE use in the Federal Energy Management Program by Federal agencies. DOE

N81-13488# Los Alamos Scientific Lab., N. Mex. Solar Energy Group, Q-11.
STUDY OF TWO PASSIVE SOLAR SYSTEMS CONTAINING PHASE CHANGE MATERIALS FOR THERMAL STORAGE
Luc E. Bourdeau (Laboratoire CNRS-PIRDES d'Energie Solaire, Nice) 1980 6 p refs Presented at the 5th Natl. Passive Solar Conf., Amherst, Mass., 19-26 Oct. 1980
(Contract W-7405-eng-36)
(LA-UR-80-1669; CONF-801016-1) Avail: NTIS HC A02/MF A01

Two passive storage collector walls using calcium chloride hexahydrate were tested. Results are presented, along with a sensitivity study on yearly performances obtained from a validated

simulation model. Advantages provided by such a material against classical storage materials are emphasized. DOE

N81-13489# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLAR PHOTOVOLTAIC SYSTEMS FOR RESIDENCES IN THE NORTHEAST
M. C. Russell 1980 5 p refs Presented at the 5th Natl. Passive Solar Conf., Amherst, Mass., 19 Oct. 1980
(Contract DE-AC02-76ET-20279)
(DOE/ET-20279/100; CONF-801016-2) Avail: NTIS HC A02/MF A01

The first phase of a program to develop residential solar photovoltaic (PV) systems involves the design, construction and testing of four prototype systems at the Northeast Residential Experiment Station. The systems employ roof mounted photovoltaic arrays of 500 to 800 square feet which provide solar generated electricity sufficient to cut in half the electrical demand of an energy efficient, passive solar residence. Construction of these systems is expected to be completed by December 1980, and will be followed by a one year test period. DOE

N81-13490# Brown Univ., Providence, R. I. Div. of Engineering.
THIN FILM CADMIUM SULFIDE/MIXED COPPER TERNARY HETEROJUNCTION SOLAR CELLS Quarterly Technical Progress Report, 13 Aug. - 12 Nov. 1979
J. J. Loferski Jun. 1980 48 p refs
(Contract DE-AC02-77CH-00178)
(SERI/PR-8012-1-T1; QTPR-3) Avail: NTIS HC A03/MF A01

The properties of pentenary films produced by RF-sputtering from a target prepared from a powder having the composition CuIn0 (3)Ga0(7)Se1 (2)Te0 (8) are discussed. Selected experimental conditions result in flims whose summary compositions are approximately CuIn sub y Ga/sub 1-y Se sub 2z Te/ sub 2(1-z), but the value of y not identical with 0.3 and of z not identical with 0.6. In general, z is substantially less than 0.6, (i.e., the films are selenium deficient) while y is only a little less than 0.3. Annealing the as-sputtered films in stoichiometric powder improves the film properties. A calculation of the limit efficiency of direct gap semiconductor p/n homojunction solar cells incorporating minority carrier mirrors and optical mirrors shows that thin cells achieve higher efficiencies than thicker cells and that for CuInSe2. A photovoltaic effect was observed in a device made from a CuInSe2 thin film produced by chemical spray pyrolysis. Photovoltaic cells having AMI efficiencies up to 13% were fabricated from large grained samples of pentenary alloys. DOE

N81-13491# Battelle Pacific Northwest Labs., Richland, Wash.
ASSESSMENT OF SOLAR OPTIONS FOR SMALL POWER SYSTEMS APPLICATIONS. VOLUME 3: ANALYSIS OF CONCEPTS
W. W. Laity, D. T. Aase, W. J. Apley, S. P. Bird, M. K. Drost, B. A. Garrett-Price, and T. A. Williams Sep. 1980 136 p refs
(Contract DE-AC06-76RL-01830)
(PNL-4000-Vol-3) Avail: NTIS HC A07/MF A01

A comparative analysis of solar thermal conversion concepts that are potentially suitable for development as small electric power systems is given. Seven generic types of collectors, together with associated subsystems for electric power generation, were considered. The collectors are classified into three categories: (1) two axis tracking (with compound curvature reflecting surfaces; (2) one axis tracking (with single curvature reflecting surfaces; and (3) nontracking (with low concentration reflecting surfaces). All seven collectors were analyzed in conceptual system configurations with Rankine-cycle engines. In addition, two of the collectors were analyzed with Brayton-cycle engines, and the latter of the two also was analyzed with Stirling-cycle engines. The SOLSTEP computer code used to determine each configuration's system cost and performance is described. DOE

N81-13492# Battelle Pacific Northwest Labs., Richland, Wash.
ASSESSMENT OF SOLAR OPTIONS FOR SMALL POWER SYSTEMS APPLICATIONS. VOLUME 4: COMPARATIVE RANKING OF CONCEPTS
J. W. Currie and M. Jannol Jul. 1980 70 p refs
(Contract DE-AC06-76RL-01830)
(PNL-4000-Vol-4) Avail: NTIS HC A04/MF A01

Seven generic type of collectors, together with associated subsystems for electric power generation, were considered. The collectors can be classified into three categories: two axis tracking (with compound curvature reflecting surfaces); one axis tracking (with single curvature reflecting surfaces; and nontracking (with low concentration reflecting surfaces). All seven collectors were analyzed in conceptual system configuration with Rankine cycle engines. In addition, two of the collectors (the Point Focus Central Receiver and the Point Focus Distributed Receiver) were analyzed with Brayton cycle engines, and the latter of the two also was analyzed with Stirling cycle engines. With these engine options, 10 systems were formulated for analysis. Descriptions of the methodology used with, and concept ranks obtained from, potential users and R and D fund allocations are included. DOE

N81-13493# Battelle Pacific Northwest Labs., Richland, Wash.
ASSESSMENT OF SOLAR OPTIONS FOR SMALL POWER SYSTEMS APPLICATIONS. VOLUME 5: SOLSTEP. A COMPUTER MODEL FOR SOLAR PLANT SYSTEM SIMULATIONS
S. P. Bird Sep. 1980 95 p refs
(Contract DE-AC06-76RL-01830)
(PNL-4000-Vol-5) Avail: NTIS HC A05/MF A01

The thermodynamic performance is analyzed on a time step basis using actual recorded meteorological and insolation data for specific geographic locations. The flexibility of the model enables the user to analyze both central and distributed generation concepts using either thermal or electric storage systems. The thermodynamic and economic analyses view the plant in a macroscopic manner as a combination of component subsystems. In the thermodynamic simulation, concentrator optical performance is modeled as a function of solar position; other aspects of collector performance can optionally be treated as functions of ambient air temperature, wind speed, and component power level. The power conversion model accounts for the effects of ambient air temperature, partial load operation, auxiliary power demands, and plant standby and startup energy requirements. The code was designed in a modular fashion to provide efficient evaluation of the collector system, total plant, and system economics. DOE

N81-13494# Los Alamos Scientific Lab., N. Mex.
PERFORMANCE ESTIMATION USING CORRELATION METHODS
J. Douglas Balcomb 1980 5 p refs Presented at the 1980 DOE Passive and Hybrid Solar Energy Program Update Meeting, Washington, D.C., 21-24 Sep. 1980
(Contract W-7405-eng-36)
(LA-UR-80-2556; CONF-800972-4) Avail: NTIS HC A02/MF A01

Correlation methods of prediction have advantages in greatly simplifying the time and complexity of performance predictions of passive solar buildings but are severely constrained in the number of variables which can be considered. Their accuracy is generally adequate for design purposes provided they are applied to buildings which correspond reasonably closely to the reference designs used in developing the correlations. Correlation techniques are especially amenable to use in microcomputer routines which can be used in a design office. Very quick answers can be obtained during the schematic design and design development phases of a building to aid in deciding between different design options. This would include trade-offs between various conservation options and passive solar options. Various correlation techhniques are described. DOE

N81-13495# Los Alamos Scientific Lab., N. Mex.
ENERGY-RELATED APPLICATIONS OF HELIUM: A REVISION OF THE ERDA-13 DATA BASE
Edward F. Hammel and Milton C. Krupka Aug. 1980 180 p refs
(Contract W-7405-eng-36)
(LA-8455-MS) Avail: NTIS HC A09/MF A01

A re-examination, revision, and re-evaluation of the data base contained within ERDA-13, The Energy-Related Applications of Helium, were completed and results are presented. New technical and resource data, current legislative proposals, updated supply and demand relationships, latest legal developments, programma-

tic changes affecting the future demand for helium, socio-economic aspects, and the effects of the latest energy consumption projections were considered and are discussed. In contrast to ERDA-13, however, explicit recommendations with respect to the formulation of Federal helium policy, as it pertains to the energy related applications of helium, are not given. DOE

N81-13496# Varian Associates, Palo Alto, Calif.
MATERIALS FOR HIGH EFFICIENCY MONOLITHIC MULTIGAP CONCENTRATOR SOLAR CELLS Quarterly Report, 1 Jan. - 31 Mar. 1980
1980 25 p refs
(Contract DE-AC02-77CH-00178)
(SERI/PR-8081-1-T1; QR-4) Avail: NTIS HC A02/MF A01

Technologies are directed towards the development of a two gap, monolithic, lattice matched concentrator cell with 28% or higher AM 2 conversion efficiency at 500 to 1000 suns. The work is subdivided into the five major tasks: (1) develop and demonstrate the technology for a grading layer of GaInAs/GaAs and low bandgap cells in AlGaInAs/GaInAs/GaAs; (2) develop and demonstrate intercell tunnel junction contacts in the higher bandgap AlGaInAs alloys; (3) develop and demonstrate technology for a higher bandgap concentrator cell in AlGaInAs alloys; (4) demonstrate a complete two gap monolithic concentrator cell with Am2 efficiency of 28% or more; and (5) investigate the potential of AlInAsSb alloys grown on InAs substrates. Progress is reported. DOE

N81-13497# Systems Control, Inc., Palo Alto, Calif.
STUDY OF DISPERSED SMALL WIND SYSTEMS INTERCONNECTED WITH A UTILITY DISTRIBUTION SYSTEM Interim Report
David Curtice, Jim Patton, Jeff Bohn, and Neil Sechan Mar. 1980 114 p refs
(Contract DE-AC04-76DP-03533)
(RFP-3093/94445/3533/80/7) Avail: NTIS HC A06/MF A01

Operating problems for various penetrations of small wind systems connected to the distribution system on a utility are defined. Protection equipment, safety hazards, feeder voltage regulation, line losses, and voltage flicker problems are studied, assuming different small wind systems connected to an existing distribution system. To identify hardware deficiencies, possible solutions provided by off-the-shelf hardware and equipment are assessed. Results of the study indicate that existing techniques are inadequate for detecting isolated operation of a small wind system. Potential safety hazards posed by small wind systems are adequately handled by present work procedures although these procedures require a disconnect device at synchronous generator and self commutated inverter small wind systems. DOE

N81-13498# Midwest Research Inst., Golden, Colo.
THERMOELECTRIC PROPERTIES OF BISMUTH-ANTIMONY THIN FILMS
J. Treffny and T. S. Jayadev Jul. 1980 6 p refs Presented at the 15th IECEC, Seattle, 18-22 Aug. 1980 Prepared in cooperation with Colorado School of Mines, Golden
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/TP-731-756; CONF-800806-39) Avail: NTIS HC A02/MF A01

In an effort to enhance the feasibility of thermoelectrics, we began investigation of potentially cheaper materials and cheaper techniques for thermoelectrics. Two features of bismuth and antimony influenced our work. Fist, Horst and Williams reported quite respectable figure of merit values in bulk single crystals of bismuth antimony, up to 2.5 x 0.001 at room temperature. Second, bismuth and antimony are an order of magnitude cheaper in cost compared to selenium and tellurium, making this binary alloy a natural candidate to reduce the cost of thermoelectric devices. Our avenue of approach involves a simplification of the fabrication process using an established technique of solid state electronics: thin film deposition. We have recently begun to investigate the extent to which the favorable properties of bulk Bi-Sb are preserved in thin films. Some of the preliminary data are reported. DOE

N81-13499# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
ENERGY-CONSUMPTION MODELLING
Elmar R. Reiter 1980 81 p refs Presented at the NOAA Workshop, Columbia, Mo., 11 Apr. 1980
(Contract DE-AS02-76EV-01340)
(COO-1340-73; CONF-8004113-1) Avail: NTIS HC A05/MF A01

A sophisticated and accurate approach is described to compute on an hourly or daily basis the energy consumption for space heating by individual buildings, urban sectors, and whole cities. The need for models and specifically weather-sensitive models, composite models, and space heating models are discussed. Development of the Colorado State University Model, based on heat transfer equations and on a heuristic, adaptive, self-organizing computation learning approach, is described. Results of modeling energy consumption by the city of Minneapolis and Cheyenne are given. Some data on energy consumption in individual buildings are included. DOE

N81-13500# Arizona State Univ., Tempe. School of Engineering.
***TERRESTRIAL PHOTOVOLTAIC POWER SYSTEMS WITH SUNLIGHT CONCENTRATION* Annual Progress Report, 1979**
C. E. Backus and B. D. Wood Jun. 1980 155 p refs
(Contract DE-AC04-76DP-00789)
(ERC-R-80025) Avail: NTIS HC A08/MF A01

A computer model was developed to predict solar cell performance under nonuniform temperature operation and experiments were performed on commercially available concentrator solar cells to validate model predictions. The magnitude of temperature nonuniformities caused by voids in the solar cell solder bond increases as the cell thickness decreases and intensity increases. Computer algorithms were developed to evaluate the performance characteristics of combined photovoltaic thermal (PV-T) solar collectors. This work emphasizes flat plate PV-T collectors but attention was also given to a detailed model for concentrating collectors. As expected, the extended fin geometries induce a greater degree of air turbulence and thus improves the fluid thermal conductance for a given mass flow rate. DOE

N81-13501# California Univ., Livermore. Lawrence Livermore Lab.
FLYWHEEL ENERGY STORAGE UNIT TECHNOLOGY DEVELOPMENT PROGRAM
Jun. 1980 212 p
(Contract W-7405-eng-48)
(UCRL-15280) Avail: NTIS HC A10/MF A01

A program to demonstrate an improved flywheel energy storage unit (ESU) to be used in combination with a heat engine for propelling a 1985 family sedan is described. Information is included on flywheel ESU design criteria, design, stress analysis thermal analysis, and performance. The ESU was designed, fabricated, and partially evaluated prior to the program being discontinued by LLL because of electrical machine failures and insufficient funds to correct the hardware discrepancies. DOE

N81-13502# California Univ., Livermore. Lawrence Livermore Lab.
HIGH DENSITY ENERGY STORAGE CAPACITOR
K. Whitham, M. M. Howland, and J. R. Hutzler Nov. 1979 5 p refs Presented at 8th Symp. on Eng. Probl. of Fusion Res., San Francisco, 13-16 Nov. 1979
(Contract W-7405-eng-48)
(UCRL-82937; CONF-791102-174) Avail: NTIS HC A02/MF A01

The Nova laser system will use 130 million joules of capacitive energy storage and have a peak power capability of 250,000 million volts. This capacitor bank is a significant portion of the laser cost and requires a large portion of the physical facilities. In order to reduce the cost and volume required by the bank, the Laser Fusion Program funded contracts with three energy storage capacitor reducers: to develop higher energy density, lower cost energy storage capacitors. Design and initial life testing are described. DOE

N81-13503# DCS Corp., Arlington, Va.
STATUS OF THERMAL IMAGING TECHNOLOGY AS APPLIED TO CONSERVATION-UPDATE 1
Frank J. Snow, James T. Wood, and Robert C. Barthle Jul. 1980 200 p
(Contract DE-AC01-78CS-20413)
(DOE/CS-20413/01) Avail: NTIS HC A10/MF A01

Thermal imaging technology is discussed in terms of airborne surveys, ground survey programs, and application needs such as standards development and lower cost equipment. Information on the various thermal imaging devices was obtained from manufacturer's standard product literature. Listings are provided of infrared projects of the DOE building diagnostics program, of aerial thermographic firms, and of aerial survey programs. DOE

N81-13504# Dow Chemical Co., Midland, Mich. Dept. of Process Development.
ENERGY FROM TRUE IN SITU PROCESSING OF ANTRIM SHALE: SAMPLING AND ANALYTICAL SYSTEMS
R. K. Pihlaja Aug. 1980 106 p refs
(Contract DE-AC01-76ET-12153)
(FE-2346-75) Avail: NTIS HC A06/MF A01

Reliable on-line analysis of production gas composition is fundamental to the success of an in situ extraction experiment in Antrim shale. An automated sampling and analysis system designed to meet this need provided high quality analytical data for three extraction trials without a single day when no data were taken. The production gas samples were routinely analyzed by both gas chromatography and a bank of continuous on-line process gas analyzers. The process gas analyzers measured CO, CO2, total hydrocarbons and O2 continuously. The process gas analyzers were shown to be especially well suited for this application because of their fast response. The GC data provided itemized composition details as well as the independent check of process analyzer data. The combination of the two analytical techniques and automated data handling yielded a versatile and powerful system. DOE

N81-13505# Dow Chemical Co., Midland, Mich. Dept. of Process Development.
ENERGY FROM TRUE IN SITU PROCESSING OF ANTRIM *SHALE: EXTRACTION TRIALS IN AN EXPLOSIVELY* FRACTURED SITE
M. L. VanDerPloeg, C. A. Peil, C. G. Kinkel, R. K. Pihlaja, D. A. Murdick, J. R. Frost, and M. M. Lund Aug. 1980 135 p refs
(Contract DE-AC01-76ET-12153)
(FE-2346-73) Avail: NTIS HC A07/MF A01

Three in situ energy extraction trials were conducted at an oil shale site in Michigan. Here the Antrim shale layer occurs between 1200 and 1400 feet underground. The three trials, lasting 7, 60 and 17 days respectively, were conducted in a formation prepared by explosive fracturing. Ignition energy was generated with a methane burner. Some energy in the form of a dilute fuel gas was recovered in each trial but upon ignition drastic decreases in flow communication occurred between injection and production wells. That problem prevented the planned exploration of techniques which would raise the energy value of the production gas. Upon cool down of the formation after each trial, air permeability tests showed inter-well communication levels returning to near preburn levels. Thermal expansion is the most likely cause of the reduced permeability experienced under retorting conditions. DOE

N81-13506# EIC, Inc., Newton, Mass.
CORROSION PROTECTION OF SOLAR-COLLECTOR HEAT EXCHANGERS WITH ELECTROCHEMICALLY DEPOSITED *FILMS Final Report, 15 May 1978 - 15 Nov. 1979*
V. R. Koch May 1980 67 p refs
(COO-4297-3) Avail: NTIS HC A04/MF A01

The electrochemical deposition of thin, adherent polymer films on the interior of heat-exchanger tubes by application of a current in the presence of a suitable organic monomer is described. Polyphenylene oxide (PPO) films were anodically deposited onto Cu and Fe coupons from methanolic media. However, defects in these films afforded poor corrosion protection. In an attempt to circumvent this problem, suitably functionalized PPO films were cross-linked via Schiff base formation in a subsequent chemical step. While these chemically modified PPO films were demonstrably more resistant to ethylene glycol H2O media at elevated temperatures, they were eventually undetermined by the thermal transfer fluid. Cinnamaldehyde, a styrene-type monomre, was successfully electrodeposited onto Al coupons. This process involved a constant, albeit unreferenced potential technique in which the Al was made the negative electrode. DOE

N81-13507# *Engineering Societies Commission on Energy, Inc.,* Washington, D. C.
RESEARCH PROGRAMS RELEVANT TO FOSSIL-ENERGY *TECHNOLOGY Final Report*
L. D. Conta Aug. 1980 61 p
(Contracts DE-AC01-77ET-10679; EF-77-C-01-2468)
(FE-2468-81) Avail: NTIS HC A04/MF A01

An overview of energy R, D, and D programs in government agencies, industry, and the professional societies as they appear to be of particular importance to the development of fossil-energy technologies is presented. The diversity of programs and sponsoring organizations involved are discussed and the inter-relationship of the research activities is pointed out. A framework is provided upon which the potential for additional technology transfer and cooperative efforts can be examined. DOE

N81-13508# *General Electric Co., Schenectady, N. Y. Dept.* of Energy Systems Programs.
DEVELOPMENT OF MOLTEN CARBONATE FUEL CELL *POWER PLANT Quarterly Report, 1 May - 31 Jul. 1980*
J. R. Peterson 4 Sep. 1980 172 p refs
(Contract DE-AC02-80ET-17019)
(DOE/ET-17019/2) Avail: NTIS HC A08/MF A01

Development of a molten carbonate fuel cell power plant to establish and demonstrate readiness for fabrication and test of full scale prototype stacks is discussed. A detailed design for a prototype stack is defined and a tenth-size of full scale cells are tested. Component and manufacturing processes are developed based upon commercial cost goals. Coal-fired utility central station and industrial cogeneration power plant requirements are defined and plant options evaluated, leading to selection of a single reference design. Specific program objectives are: (1) to define a reference power plant for a coal-fired molten carbonate power plant; (2) to develop and verify cell and stack design based upon the requirements of the reference power plant design; (3) to establish and demonstrate readiness to fabricate and test full length stacks of full scale cells, called prototype stacks; and (4) to quantify contaminant effects and establish a program to verify performance of molten carbonate fuel cells operating on products of coal gasification. DOE

N81-13509# Bechtel National, Inc., San Francisco, Calif. Research and Engineering Div.
WIND DESIGN OF FLAT PANEL PHOTOVOLTAIC ARRAY STRUCTURES Final Report
Jun. 1980 174 p refs
(Contract DE-AC04-76DP-00789)
(SAND-79-7057) Avail: NTIS HC A08/MF A01

Feasible low cost structures for solar photovoltaic central power plants were studied. Wind load magnitudes for these arrays significantly influence structural costs. Wind load prediction is hampered by the lack of specific information for these unique structures. A wind-tunnel test program gave wind force coefficients for single or large-field photovoltaic arrays and the resulting design criteria are reported. DOE

N81-13510# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ANALYTICAL PREDICTIONS OF LIQUID AND AIR PHOTOVOLTAIC/THERMAL FLAT PLATE COLLECTOR PERFORMANCE
P. Raghuraman and S. D. Hendrie 1980 8 p refs Presented at the ASME Winter Ann. Meeting, Chicago, 16-21 Nov. 1980
(Contract DE-AC02-76ET-20279)
(COO-4049-89; CONF-801102-23) Avail: NTIS HC A02/MF A01

The analyses account for the temperature differences between the primary insolation absorber (the photovoltaic cells) and the secondary absorber (a thermal absorber flat plate). The results of the analyses are compared with test measurements, and

therefore, design recommendations are made to maximize the total energy extracted from the collections. DOE

N81-13511# Aerospace Corp., El Segundo, Calif. Energy and Resources Div.

SOLAR HEATING AND COOLING OF BUILDINGS (SHACOB): REQUIREMENTS DEFINITION AND IMPACT ANALYSIS, 2 Final Report

C. K. Cretcher Sep. 1980 53 p 4 Vol.
(EPRI Proj. 553-2)
(EPRI-EM-1506-SY) Avail: NTIS HC A04/MF A01

A study conducted to determine the potential impact of the widespread implementation of solar heating and cooling systems on the utility load, utility operating costs, and customer costs for the years 1990 and 2000 is summarized. Although results and recommendations vary among the utilities and regions studied, SHACOB installations can result in reduced electric demand. In addition, savings in utility operating costs and capital requirements for new plant construction may accrue to the utilities. DOE

N81-13512# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.

DYNAMIC MODELING AND EXPERIMENTAL SIMULATION OF ACTIVE SOLAR ENERGY SYSTEMS FOR THE EVALUATION OF CONTROL STRATEGIES

Steven R. Schiller, Mashuri L. Warren, and Michael Wahlig Jul. 1980 9 p refs Presented at the ASME Winter Ann. Meeting, Chicago, 16-21 Nov. 1980
(Contract W-7405-eng-48)
(LBL-10825; CONF-801102-26) Avail: NTIS HC A02/MF A01

Dynamic modeling and experimental simulation are used to evaluate control strategies for active solar energy systems. Performance of proportional and on/off collector loop controllers are evaluated and compared using a theoretical dynamic collector model. The effect of controls and control strategies on hydronic space heating system performance is discussed. Both the computer model and the test facility allow evaluation of control strategies using various flow rates, controller set points, insolation patterns, ambient temperature conditions, and collector types. The test facility also allows comparison of collector and load loop flow stragegies based on various system configurations and building load demands. DOE

N81-13513# Battelle Human Affairs Research Centers, Seattle, Wash.

INSTITUTIONAL ANALYSIS FOR ENERGY POLICY

F. A. Morris and R. J. Cole Jul. 1980 178 p refs
(Contract DE-AC06-76RL-01830)
(PNL-3529) Avail: NTIS HC A09/MF A01

The Regional Issues Identification and Assessment (RIIA) program identifies environmental, health, safety, socioeconomic, and institutional issues that could accompany hypothetical future scenarios for energy consumption, and production on a regional basis. Theoretical grounding in institutional analysis and information on constructing institutional maps of the processes for bringing on line energy technologies and facilities contemplated in RIIA scenarios is presented. The institutional constraints, opportunities and impacts that affect whether these technologies and facilities would in fact be developed were assessed. DOE

N81-13514# Midwest Research Inst., Golden, Colo. Solar Thermal Research Branch.

SOLAR ENERGY STORAGE PROGRAM: FY79 Annual Report

Charles E. Wyman, Robert J. Copeland, John D. Wright, and Frank Baylin May 1980 12 p refs
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/PR-631-636) Avail: NTIS HC A02/MF A01

A ranking methodology was developed for selection of thermal energy storage technologies for solar thermal applications. The ranking is based on cost and performance data. Thermal storage value data based on costs of alternative energy systems were generated for electric power plants and will be used for cost goals as a preliminary thermal storage screening tool. A survey was completed of thermal energy storage technologies, projects, and economics. An analysis was made of latent heat storage for solar heating based on previous system simulations. The only major advantage shown for latent heat storage is a reduced storage volume and not the improved solar system performance frequently postulated. Therefore, latent heat storage must be competitively priced with sensible heat options. Direct contact latent heat storage offers satisfactory low cost potential and could be used for a wide range of temperatures. DOE

N81-13515# Midwest Research Inst., Golden, Colo.

CENTRAL UNRESOLVED ISSUES IN THERMAL ENERGY STORAGE FOR BUILDING HEATING AND COOLING

C. J. Swet and F. Baylin Jul. 1980 48 p refs
(Contract DE-AC02-77CH-00178)
(SERI/RR-721-455) Avail: NTIS HC A03/MF A01

Issues related to applications included value-based ranking of storage concepts, temperature constraints, consistency of assumptions, nomenclature and taxonomy, and screening criteria for materials. Issues related to technologies included assessing seasonal storage concepts, diurnal coolness storage, selection of hot-side storage concepts for cooling-only systems, phase-change storage in building materials, freeze protection for solar water heating systems, and justification of phase-change storage for active solar space heating. DOE

N81-13516# Midwest Research Inst., Golden, Colo. Building Systems Development Branch.

SYSTEMS ANALYSIS TECHNIQUES FOR ANNUAL CYCLE THERMAL ENERGY STORAGE SOLAR SYSTEMS

F. Baylin Jul. 1980 34 p refs
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/RR-721-676) Avail: NTIS HC A03/MF A01

Community-scale annual cycle thermal energy storage solar systems are options for building heat and cooling. A variety of approaches are feasible in modeling ACTES solar systems. The key parameter in such efforts, average collector efficiency, is examined, followed by several approaches for simple and effective modeling. Methods are also examined for modeling building loads for structures based on both conventional and passive architectural designs. Two simulation models for sizing solar heating systems with annual storage are presented. Validation is presented by comparison with the results of a study of seasonal storage systems based on SOLANSIM, an hour-by-hour simulation. These models are presently used to examine the economic trade-off between collector field area and storage capacity. Programs directed toward developing other system components such as improved tanks and solar ponds or design tools for ACTES solar systems are examined. DOE

N81-13517# Kinetics Technology International Corp., Pasadena, Calif.

ASSESSMENT OF FUEL PROCESSING SYSTEMS FOR DISPERSED FUEL CELL POWER PLANTS Interim Report, Mar. - Aug. 1980

R. G. Minet, D. Warren, T. Tomita, K. Hirokawa, K. Osaki, and T. Shinjo Aug. 1980 132 p refs . Prepared in cooperation with Toyo Engineering Corp., Chiba, Japan
(EPRI Proj. 1041-1)
(EPRI-EM-1487) Avail: NTIS HC A07/MF A01

The results of bench scale reforming tests of No. 2 fuel oil using sulfur tolerant reforming catalysts were examined. The comparative economics for use of such a catalyst in a Hybrid reformer train and a regenerative type light temperature steam reformer HTSR alone are presented. The sulfur tolerant catalyst system was tested over a wide range of conditions using No. 2 fuel oils of different sulfur and aromatic content. Tests were carried out using a regenerative type reformer tube as well as a conventional single pass tube. The experimental results were reviewed, the data correlated, and preliminary design parameters for this catalyst were developed. In addition, the catalyst limitations and the requirements of the reformer trains to integrate efficiently with the fuel cell are outlined. Estimates are presented for two fuel processing trains for a nominal 4.8 MW fuel cell power plant: a regenerative type HTSR and a Hybrid system using a regenerative HTSR in a combination with an auto thermal reformer. DOE

N81-13518# Sandia Labs., Albuquerque, N. Mex. Electronic and Transport Phenomena in Solids Div.

SINGLE CELL HIGH CONCENTRATION SOLAR TEST

FACILITY
B. E. Gene Hammons Sep. 1980 34 p ref
(Contract DE-AC04-76DP-00789)
(SAND-80-1737) Avail: NTIS HC A03/MF A01

The facility uses a 71 cm diameter Fresnel lens as the concentrator. The lens and solar cell (with appropriate cooling fixtures) are mounted on a 2 axis tracking pedestal which is positioned by a sun seeking tracking device. The intensity of the incoming solar insolation is measured by a normal incidence pyrheliometer attached to this same tracking pedestal. Cell cooling is accomplished by the liquid impingement technique, and temperatures are held constant by a variable flow rate cooling loop using a 50/50 mixture of glycol/water as the coolant. Safety interlocks prevent the operator from being exposed to the high intensity solar radiation. Data acquisition and the associated instrumentation are controlled by a desk top computer. The computer also provides the user with a variety of cell parameters and methods of viewing the test results. Author

N81-13519# Sandia Labs., Albuquerque, N. Mex.
DEPARTMENT OF ENERGY LARGE SOLAR CENTRAL POWER SYSTEMS SEMIANNUAL REVIEW
Jun. 1980 348 p Review held in Albuquerque, N. Mex., 19-20 Mar. 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-8505) Avail: NTIS HC A15/MF A01

An overview of recent developments in the area of solar technology is presented. Specific topics discussed include cogeneration, central receiver systems, solar retrofitting, heliostats, and solar thermal power systems. J.M.S.

N81-13520# Sandia Labs., Albuquerque, N. Mex.
VERTICAL AXIS WIND TURBINE FOUNDATION PARAMETER STUDY
P. F. Ludde Jul. 1980 38 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-7015) Avail: NTIS HC A03/MF A01

The foundation/anchor requirements for the Vertical Axis Wind Turbine are identified. Information is supplied concerning the selection, design, and cost estimates for the geologic conditions which may be encountered at potential wind turbine sites. L.F.M.

N81-13521# Sandia Labs., Livermore, Calif. Heliostat Development Div.
STATUS AND RECOMMENDED FUTURE OF PLASTIC-ENCLOSED HELIOSTAT DEVELOPMENT
C. L. Mavis Oct. 1980 56 p refs Sponsored by DOE
(SAND-80-8032) Avail: NTIS HC A04/MF A01

Tests shows that biaxially oriented Kynar film has excellent weathering properties as an enclosure material and is practical to manufacture commercially. Reflectors using Kynar or weatherized polyester also appear to be feasible. The projected low cost of properly designed plastic enclosed heliostats indicates that further development effort should be continued. Both Boeing's one piece enclosure and reflectors need to be fabricated and set up at several desert locations to verify the designs and obtain weathering data under actual use conditions. Author

N81-13522# Sandia Labs., Albuquerque, N. Mex.
MODAL TESTING OF THE VERTICAL AXIS WIND TURBINE
Doris E. Miller and Arlo R. Nord 1980 23 p ref
(SAND-80-1639C; CONF-800746-1) Avail: NTIS HC A02/MF A01

Modal tests performed on two bladed and three bladed vertical axis wind turbines are described. Results are inconclusive and further testing is recommended. L.F.M.

N81-13523# Sandia Labs., Albuquerque, N. Mex.
TORQUE RIPPLE IN A DARRIEUS, VERTICAL AXIS WIND
Robert C. Reuter, Jr. 1980 17 p refs Presented at the ASME Winter Ann. Meeting, Chicago, 16 Nov. 1980
(Contracts DE-AC04-76DP-00789; AT(29-1)-789)
(SAND-80-0475C; CONF-801102-3) Avail: NTIS HC A02/MF A01

Interaction between a steady wind and a rotating, Darrieus, vertical axis wind turbine produces time periodic aerodynamic loads which cause time dependent torque variations, referred to as torque ripple, to occur in the mechanical link between the turbine and the electrical generator. The effect of torque ripple upon fatigue life of drive train components and upon power quality was investigated. An analytical solution characterizing the phenomenon of torque ripple was obtained which is based upon a Fourier expansion of the problem. Numerical results for torque ripple, some experimental data, determination of acceptable levels and methods of controlling it, are presented and discussed. DOE

N81-13524# Sandia Labs., Albuquerque, N. Mex.
STEADY-STATE WIND LOADING ON PARABOLIC-TROUGH SOLAR COLLECTORS
Duane E. Randall, Donald D. McBride, and Roger E. Tate Aug. 1980 20 p refs
(Contract DE-AC04-76DP-00789)
(SAND-79-2134) Avail: NTIS HC A02/MF A01

Two wind tunnel force and moment tests were conducted on parabolic-trough solar collector configurations. The two tests were conducted in different flow field environments, one a uniform flow infinite airstream, the second a simulated atmospheric boundary layer flow with the models simulating a ground mounted installation. The force and moment characteristics of both isolated single module troughs and of trough modules within array configurations were defined over both operational and stow attitudes. The influence of various geometric design parameters for collector modules and arrays were established. Data indicate that forces and moments increase with mounting height and with trough aspects ratio. Collector modules interior to large arrays experience wind force reductions as high as 50 to 65%, while appropriate fences or berms surrounding the arrays can provide exterior modules with protection of this order. DOE

N81-13525# Sandia Labs., Albuquerque, N. Mex. Solar Energy Projects Dept.
FREQUENCY RESPONSE ANALYSIS OF FLUID CONTROL SYSTEMS FOR PARABOLIC TROUGH SOLAR COLLECTORS
Rudolph Schindwolf 1980 27 p refs Presented at the ASME Winter Ann. Meeting, Chicago, 16 Nov. 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-0385C; CONF-801102-5) Avail: NTIS HC A03/MF A01

A linearized steady state frequency response is derived for parabolic trough collectors and for connecting piping, which can be used in standard gain phase analyses to evaluate system stability and closed loop frequency response. The frequency response characteristics of a typical collector string and piping are used in a gain phase analysis to get some insight into the effect on system stability of various system parameters such as controller gain, sensor and controller time constants, and sensor location. DOE

N81-13526# RCA Labs., Princeton, N. J. Display and Energy Systems Research Lab.
AMORPHOUS THIN FILMS FOR SOLAR-CELL APPLICATIONS
D. E. Carlson, R. S. Crandall, J. Dresner, B. Goldstein, J. J. Hanak, J. I. Pankove, H. E. Schade, D. L. Staebler, H. A. Weakliem, and R. Williams Jun. 1980 76 p refs
(Contract DE-AC02-77CH-00178)
(SERI/PR-0-8254-3) Avail: NTIS HC A05/MF A01

A research program on hydrogenated amorphous silicon (a-Si:H) and the a-Si:H solar cell is described. Theoretical modeling, deposition and doping studies, experimental methods for the characterization of a-Si:H, formation of solar cell structures, theoretical and experimental evaluation of solar cell parameters, and an investigation of stacked junction cells are discussed. DOE

N81-13527# Prototech, Inc., Newton Highlands, Mass.
ENERGY SAVINGS BY MEANS OF FUEL CELL ELECTRODES IN ELECTRO-CHEMICAL INDUSTRIES Progress Report, 1 Nov. 1979 - 31 Jan. 1980
Amicam Bar-Ilan, Walter Juda, Robert J. Allen, and Robert W. Lindstrom 18 Apr. 1980 42 p refs
(Contract DE-AC02-78ET-25309)
(COO-4881-16) Avail: NTIS HC A03/MF A01

Zinc electrowinning data, obtained with hydrogen depolarized anodes operating in a plant feed electrolyte at 55 C, are presented.

Performance of an anode containing a low platinum loading and an anode catalyzed with palladium instead of platinum is described. A feed and bleed system to maintain a constant electrolyte composition was developed. The effect upon cell voltage of decreasing the hydrogen flowrate to the anode by dilution of the feed gas with nitrogen was studied. The effect upon energy consumption and current efficiency of varying the current density and the Zn ion concentration was determined. DOE

N81-13528# PRC Energy Analysis Co., McLean, Va.
SOLAR PHOTOVOLTAIC APPLICATIONS SEMINAR: DESIGN, INSTALLATION AND OPERATION OF SMALL, STAND-ALONE PHOTOVOLTAIC POWER SYSTEMS
Jul. 1980 351 p refs
(Contract DE-AC01-77CS-32522)
(DOE/CS-32522/T1) Avail: NTIS HC A16/MF A01

An introduction to photoconductivity, semiconductors, and solar photovoltaic cells is included along with a demonstration of specific applications and application identification. Small solar cell power system design engineering is discussed. Solar PV power system applications involve classical direct electrical energy conversion and electric power system analysis and synthesis. Presentations and examples involve a variety of disciplines including structural analysis, electric power and load analysis, reliability, sizing and optimization; and, installation, operation and maintenance. Four specific system designs are demonstrated: water pumping; domestic uses; navigational and aircraft aids; and telecommunications. All of the applications discussed are for small power requirement (under 2 kilowatts), stand alone systems to be used in remote locations. DOE

N81-13529# Oak Ridge National Lab., Tenn.
ROLE OF CONSERVATION IN PLANNING FOR AN ENERGY EMERGENCY: HOME AND WORK PLACE ENERGY USE
Roger S. Carlsmith Jun. 1980 29 p refs Presented at the Contingency Planning for an Energy Emergency Conf., Stanford, Calif., 16-18 Jun. 1980
(Contract W-7405-eng-26)
(CONF-8006120-1) Avail: NTIS HC A03/MF A01

Prospects for making substantial reductions in energy consumption in the residential, commercial, and industrial sectors are discussed. Steps to deal with an emergency and with preparations that can be started now to reduce our vulnerability are described. Higher energy prices will continue to be the principal driving force for conservation. Congress has promulgated a program of encouraging conservation through regulations, financial measures, and information programs. Some of the most important are energy performance standards for new buildings, assistance in retrofitting residential buildings, and grants for institutional buildings. The planning for emergency situations remains incomplete. Proposed emergency measures (with the exception of gasoline rationing) focus largely on reduction of nonessential uses of energy. The potential reductions achievable by such measures would fall far short of the requirements in a serious emergency such as a cutoff of all imports from the mideast. DOE

N81-13530# Oak Ridge National Lab., Tenn. Energy Div.
PERFORMANCE AND ECONOMICS OF USING HEAT PUMP DESUPERHEATERS FOR RESIDENTIAL WATER HEATING
Leonard A. Abbatiello, E. A. Nephew, and M. L. Ballou 1980 14 p refs Presented at the Conf. on Waste Heat Recovery for Energy Conserv.: Residential and Light Com. Heat Pumps, West Lafayette, Ind. 15-17 Sep. 1980
(Contract W-7405-eng-26)
(CONF-800966-1) Avail: NTIS HC A02/MF A01

The homeowner using a desuperheater water heater system should expect effective annual water heating COPs which range from 1.3 for northern cities to 2.9 in southern cities. The average consumer could expect to save between 800 and 2500 kWh/year if he is presently heating water with a conventional electric water heater. Should the homeowner elect to install a heat pump water heater within the thermal envelope of his air-to-air heat pumped home, he could expect similar savings. The major economic conclusions of this study are: the desuperheater water heater can save a significant amount of energy at attractive life cycle costs and acceptable first costs if the owner is choosing between electrically powered alternatives; heat pump water heaters offer savings which are comparable to those of the desuperheater system in all regions of the country; water heating with natural gas still offers the lowest first and life cycle costs of all alternatives. DOE

N81-13531# Monosolar, Inc., Santa Monica, Calif.
EMERGING MATERIALS FOR SOLAR CELL APPLICATIONS: ELECTRODEPOSITED CdTe Quarterly Report, 15 Feb. - 15 May 1980
Robert L. Rod, Bulent M. Basol, and Oscar Stafsudd 30 Jun. 1980 17 p refs
(Contract DE-AC02-77CH-00178)
(DOE/CH-00178/T3; QR-1) Avail: NTIS HC A02/MF A01

The electrochemically deposited films of compound semiconductors and solar cells made from them are discussed. Solar cells over 1 square centimeter in area conversion efficiencies exceeding 4 percent expected. Prototype electrodeposited CdTe solar cells were fabricated and evaluated. Characterizations of p type CdTe and ZnTe films were complicated by interferences existing between them and adjacent substrates. The highest internal efficiency of the Schottky devices, which have yet to have fingered grids and antireflection coatings applied is 4 percent. The heterojunction is a larger area device 2 square centimeters in area. It shows promise of meeting the 4 percent total area efficiency as does the Schottky when grids and A/R coatings are applied. DOE

N81-13532# Monosolar, Inc., Santa Monica, Calif.
EMERGING MATERIALS FOR SOLAR CELL APPLICATIONS: ELECTRODEPOSITED CdTe Final Report, 14 Feb. 1979 - 14 Feb. 1980
Robert L. Rod, Rointain Bunshah, Oscar Stafsudd, Bulent M. Basol, and Prem Nath 15 May 1980 80 p refs
(Contract DE-AC04-79ET-23008)
(DOE/ET-23008/T1) Avail: NTIS HC A05/MF A01

Thin film gold/polycrystalline cadmium telluride Schottky solar cells made by electrodepositing the semiconductor on an ITO coated glass substrate serving also as an ohmic contact demonstrated an internal efficiency of 4 percent over 2 square millimeter areas. Refining the electroplating process and determining the parameters governing CdTe film stoichiometry, grain size, substrate adhesion, and quality are emphasized. Techniques were developed for making measurements on films often less than 1 micron in thickness. Larger and more efficient low cost solar devices can readily be obtained using the techniques developed. DOE

N81-13533# Martin Marietta Corp., Denver, Colo.
SOLAR CENTRAL RECEIVER HYBRID POWER SYSTEM, PHASE 1. VOLUME 1: EXECUTIVE SUMMARY Final Technical Report, Oct. 1978 - Aug. 1979
Sep. 1979 34 p ref
(Contract ET-78-C-03-2234)
(DOE/ET-21038/1-Vol-1) Avail: NTIS HC A03/MF A01

The analysis shows that in the 1990 time frame, hybrid and solar standalone power systems based on molten salt technology are competitive with peaking, intermediate and baseload conventional power technology. The hybrid plant consists of solar and nonsolar portions of the plant that operate in parallel. For the solar portion of the plant, molten salt is heated in cavity receivers and delivered to salt storage tanks. The hot salt is used to generate steam for the turbine in salt heat exchangers. For the nonsolar portion of the plant, molten salt is heated in a fossil fired salt heater and delivered to the salt storage tanks. The large quantities of storage and associated heliostats result in large plant capacity factors (0.75) from the solar portion of the plant, minimize the busbar energy costs, permit nonsolar subsystems less than the plant rating and minimize the amount of fossil fuel burned. An executive summary of the selection of the preferred system configuration, conceptual design, assessment of the commercial plant, and development plan is presented. DOE

N81-13534# Lockheed Missiles and Space Co., Palo Alto, Calif. Palo Alto Research Lab.
CADMIUM SULFIDE/COPPER SULFIDE HETEROJUNCTION CELL RESEARCH Final Report, 26 Feb. 1979 - 31 May 1980

W. W. Anderson and A. D. Jonath Jun. 1980 68 p refs
(Contract DE-AC02-77CH-0017)
(LMSC-D766341) Avail: NTIS HC A04/MF A01

Several all sputter deposited Cu2S/CdS cells were prepared with J/sub SC/ = 3 mA/sq cm under simulated AM 1 illumination. The best AM 1 conversion efficiency obtained is 0.6 percent. This is typical of sputtered CdS in Cu2S/CdS cells investigated. The sputtered Cu2S appears to be satisfactory for solar cell applications. Present evidence indicates that the poor conversion efficiency is due to a low junction electric field intensity on the CdS side of the heterojunction. A multilayered CdS structure was developed which may allow the tailoring of the junction electric field intensity to a selected high value to obtain high junction collection efficiency. Hybrid process cells consisting of sputter deposited CdS with conventional dry processed Cu2S were also prepared. The best of these cells exhibited a short circuit current density of 6.9 mA/sq cm and a conversion efficiency of 1.18 percent. DOE

N81-13535# General Electric Co., Schenectady, N. Y. Energy Systems Program Dept.
ALTERNATE CENTRAL RECEIVER POWER SYSTEM PROGRAM, PHASE 2 Midterm Technical Report
Jul. 1980 101 p refs
(Contract DE-AC03-79SF-10535)
(DOE/SF-10535/1-3) Avail: NTIS HC A06/MF A01

A technique/procedure for the furnace brazing of thin walled tubular Incoloy 800 absorber panels for sodium cooled solar central receiver plants is described. This development included selection of a brazing filler metal type, form and application procedure determination of a joint design that would result in good brazibility and mechanical properties, and the selection of an appropriate panel brazing procedure, atmosphere control, orientation and fixturing method in a brazing furnace. Over 100 test specimens were fabricated and brazed. DOE

N81-13536# Purdue Univ., Lafayette, Ind.
SELECTIVE SOLVENTS EXTRACTION IN UTILIZATION OF STORED SOLAR ENERGY IN CELLULOSIC BIOMASS Final Report, 1 Jan. 1978 - 31 Dec. 1979
George T. Tsao 1 Jul. 1980 292 p refs
(Contract DE-AC02-78ET-20481)
(DOE/ET-20481/4) Avail: NTIS HC A13/MF A01

Work on cellulose utilization which analyzes treatment of lignocellulose materials with various cellulose solvents to enhance the rate and extent of cellulose conversion to glucose is discussed. The mechanism of cellulose solvents in dissolving cellulose the hydrolysis of solvent treated cellulose, aqueous gel permeation chromatography, membrane reactor for enzymatic hydrolysis of cellulose, and the fermentation of corn stover hemicellulose hydrolysis to butanediol and ethanol are included. DOE

N81-13537# Pennsylvania State Univ., University Park. Materials Research Labs.
BLACK GERMANIUM SELECTIVE ABSORBER SURFACES Final Report, 1 Sep. 1978 - 30 Jun. 1979
R. Messier, K. Vedam, and S. V. Krishnaswamy Dec. 1979 38 p refs
(Contracts DE-AC04-78CS-35302; EM-78-C-04-5302)
(DOE/CS-35302/T1) Avail: NTIS HC A03/MF A01

Due to their high refractive index, semiconductor films have high reflectance above their absorption edge which limits their total absorption. A coating which would retain the advantages of the semiconductor's selectivity and also reduce the reflectance form the present values of 30 to 50 percent to a level of less than 2 percent is desirable. Work on the preparation and characterization of structurally anisotropic black Germanium films by radio frequency sputtering and postdeposition etching is described. By controlling the sputtering preparation conditions of noncrystalline Ge films, the surface microstructure can be drastically altered. The total reflectance of the resulting surface was reduced from about 45 percent to less than 1 percent. Furthermore, the films appear black over a wide range of angles of incidence (up to 45 percent from the normal). This flat black appearance is due to a dense array of aligned, needle like protrusions which have an extremely high aspect ratio and both a cross sectional area and a separation between the needles on the order of the wavelength of solar radiation. DOE

N81-13538# NEUS, Inc., Santa Monica, Calif.
BIOSOURCES DIGEST: A JOURNAL ON BIOMASS UTILIZATION, VOLUME 2, NO. 1 Quarterly Report
Harry Sobel Jan. 1980 74 p refs
(Grant NSF PFR-77-12500)
(PB80-209364; NSF/RA-800060-Vol-2-No-1) Avail: NTIS HC A04/MF A01 CSCL 10A

Current research in biotechnology in Turkey is summarized. Grant awards are listed by title, author, and institution together with abstracts. Publications received are itemized as are pertinent patents and a schedule of forthcoming meetings. Five technical articles are presented; kinetics and mechanisms of steam gasification of biomass in the presence of alkali carbonates; a low investment approach to alcohol fermentation; Sheldon-Arleta Landfill gas recovery Facility; strip-mined land revegetation using municpal sludge; and bioconversion of plant residues into chemicals; production of chemicals from lignin. GRA

N81-13539# NEUS, Inc., Santa Monica, Calif.
BIOSOURCES DIGEST: A JOURNAL ON BIOMASS UTILIZATION, VOLUME 2, NO. 2 Quarterly Report
Harry Sobel Apr. 1980 81 p refs
(Grant NSF PFR-77-12500)
(PB80-210214; NSF/RA-800084-Vol-2-No-2) Avail: NTIS HC A05/MF A01 CSCL 10A

Technical papers are presented on the following subjects: thermochemical conversion activities funded by the biomass energy systems branch, U.S. Dept. of Energy; a microbial route for acrylic acid production; the supply of Douglas Fir and its potential for biomass utilization; California's program converts biomass residues to energy; opportunites and plans for a biosolar economy in Brazil, and its challenge to the developed world; and testimony on alcohol fuels. Grant awards are listed by title, award number, principle investigator institution, and project description. The title, author, and price of recent publications are given. Pertinent patents are listed by number, title, and inventor. GRA

N81-13540# National Bureau of Standards, Washington, D.C. National Engineering Lab.
ESTIMATING THE HEATING SEASONAL OPERATING COST OF RESIDENTIAL HYBRID HEAT PUMP SYSTEMS, INCLUDING UNITS RETROFITTED TO OIL, GAS AND ELECTRIC FURNACES
George E. Kelly and Peter Domanski Jul. 1980 44 p refs Sponsored in part by DOE, Washington, D.C.
(PB80-223142; NBSIR-80-2090) Avail: NTIS HC A03/MF A01 CSCL 13A

A method is presented for estimating the heating seasonal operating cost of a residential, hybrid heating system consisting of an electric heat pump and a warm-air furnace. The approach described is applicable to a heat pump/control system/gas or oil-fired furnace which is sold as a package or to a heat pump/control system which is intended to be added to an existing gas, oil, or electric furnace. Recommendations are made regarding how such systems can be rated and the type of information that would assist consumers in comparing the operating cost of a hybrid pump system with that of a conventional heat pump or furnace. Different control strategies are accounted for and examples are presented for estimating the heating seasonal operating cost of hybrid systems employing both single and two speed compressors. GRA

N81-13541# National Bureau of Standards, Washington, D.C.
MEASUREMENT TECHNIQUES FOR SOLAR CELLS, Annual Report, 15 Sep. 1977 - 14 Dec. 1978
D. E. Sawyer, H. H. Kessler, and H. A. Schafft Jul. 1980 70 p refs Sponsored in part by DOE
(PB80-223134; NBSIR-80-2027) Avail: NTIS HC A04/MF A01 CSCL 10B

A technique was developed which employs forward biasing during laser scanning of the solar cell to reveal defects including cracks, metallization breaks, and regions of metallizations not in ohmic contact with the underlying semiconductor. The experimental results obtained are consistent with predictions made by a first order theory developed in house, and by subsequent mathematical modeling. Single crystal silicon artifacts were designed to couple laser scanning measurements with mathemati-

cal analyses to define quantatively the capabilities of the laser scanner techniques to detect cell defects and spatial nonuniformaties of cell performance. GRA

N81-13542# Bureau of Economic Analysis, Washington, D. C. Regional Economic Analysis Div.

THE ESTIMATION OF ECONOMIC AND DEMOGRAPHIC IMPACTS FOR DEPARTMENT OF ENERGY ALTERNATIVE SCENARIOS

Kenneth P. Ballard Apr. 1980 171 p refs
(Contract EL-78-C-01-6399)
(PB80-208325; BEA/REA-80/01) Avail: NTIS HC A08/MF A01 CSCL 10A

A multistate interactive econometric model of the U.S. economy is used to estimate the spatial distribution of impacts from model forecasts of energy development alternatives. The model is overviewed to familiarize the reader with the structure, advantages, and limitations of this multiregional modeling system. The linking methodology between the energy forecasting model and the multiregional economic-demographic model is described. The results of the application of this methodology are presented. General conclusions follows. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N81-13543 New York Univ., N. Y.

THE DEVELOPMENT OF A CONTINUOUS MONITOR FOR THE MEASUREMENT OF ENVIRONMENTAL RADON Ph.D. Thesis

Passaporn Chittaporn 1980 209 p
Avail: Univ. Microfilms Order No. 8027873

The detector is cylindrical in design and is lined with a scintillation phosphor composed of zinc sulfide (ZnS) on a Mylar substrate. An electret is located above the detection chamber. The electret is a Teflon polymer which maintains an electrostatic potential for long periods of time. The electret acts as a collecting electrode to collect radon daughters and remove them from the sensitive counting volume. In this way, only alpha particles emitted by radon itself are detected by the ZnS alpha phosphor. The scintillations that are produced, are converted into an electrical signal by a photomultiplier tube. The ambient air concentration is maintained in the detector by passive diffusion into a light-tight outer housing and thence into the cylindrical detector. The parameters for optimum detection chamber design are presented. Several detection chambers were constructed and their characteristics studied. The optimum collecting potential for the electret was determined and a relatively simple method for preparing suitable electrets is described. Dissert. Abstr.

N81-13544# Argonne National Lab., Ill. Energy and Environmental Systems Div.

ANALYSIS FOR THE ACCURACY DEFINITION OF THE AIR QUALITY ASSESSMENT MODEL (AQAM) AT WILLIAMS AIR FORCE BASE, ARIZONA. VOLUME 1: TECHNICAL DISCUSSION Final Report, Jul. 1976 - Mar. 1980

R. J. Yamartino, L. A. Conley, D. M. Rote, F. J. Lamich, E. P. Dunphy, and K. F. Zeller Tyndall AFB, Fla. Air Force Engineering and Services Center Mar. 1980 140 p refs
(AF Proj. 1900)
(AD-A091171; AFESC/ESL-TR-80-19-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 12/1

The Air Quality Assessment Model (AQAM) overall predictive accuracy is analyzed using actual air base ambient air quality measurements. These measurements of CO, NO, NO(x), THC, CH4, and visibility at Williams Air Force Base, Arizona, from June 1976 to June 1977 were compared with AQAM predicted air pollution concentrations to determine AQAM's predictive power. The AQAM accuracy is analyzed on an hour-by-hour basis and statistical bases using accumulative frequency distribution. The conclusions are that AQAM accuracy is well within the accuracy range expected for Gaussian urban dispersion models. Even though an attempt was made to select an isolated base from urban background emissions, the background concentration had to be accounted for in the analysis. Concentrations in the air base vicinity were extremely low when compared with background concentrations resulting from urban transport. Without the background concentration adjustments, the AQAM model tended to underpredict the pollutant concentrations. The results also indicate that AQAM is especially accurate in simulating the potential worst case airbase concentrations associated with morning hours, low wind speeds, stable atmospheric conditions, and high activity. GRA

N81-13545# Argonne National Lab., Ill. Energy and Environmental Systems Div.

IMPACT OF AIRCRAFT EMISSIONS ON AIR QUALITY IN THE VICINITY OF AIRPORTS. VOLUME 2: AN UPDATED MODEL ASSESSMENT OF AIRCRAFT GENERATED AIR POLLUTION AT LAX, JFK AND ORD Final Report, Jan. 1978 - Jul. 1980

R. J. Yamartino, D. G. Smith, S. A. Bremer, D. Heinold, D. Lamich, and B. Taylor Jul. 1980 88 p refs Prepared in cooperation with Environmental Research and Technology, Inc., Concord, Mass.
(Contract DOT-FA77WAI-736)
(AD-A091005; FAA-EE-80-09B-Vol-2) Avail: NTIS HC A05/MF A01 CSCL 13/2

This report documents the results of the Federal Aviation Administration (FAA)/Environmental Protection Agency (EPA) air quality study which has been conducted to assess the impact of aircraft emissions of carbon monoxide (CO), hydrocarbons (HC), and oxides of nitrogen (NOx) in the vicinity of airports. This assessment includes the results of recent modeling and monitoring efforts at Washington National (DCA), Los Angeles International (LAX), Dulles International (IAD), and Lakeland, Florida airports and an updated modeling of aircraft generated pollution at LAX, John F. Kennedy (JFK) and Chicago O'Hare (ORD) airports. The Airport Vicinity Air Pollution (AVAP) model which was designed for use at civil airports was used in this assessment. In addition, the results of the application of the military version of the AVAP model the Air Quality Assessment Model (AQAM) are summarized. Both the results of the pollution monitoring analyses in Volume 1 and the modeling studies in Volume 2 suggest that: maximum hourly average 60 CO concentrations from aircraft are unlikely to exceed 5 parts per million (ppm) in areas of public exposure and are thus small in comparison to the National Ambient Air Quality Standard of 35 ppm; maximum hourly HC concentrations from aircraft can exceed 0.25 ppm over an area several times the size of the airport; and while annual average NO2 concentrations from aircraft are estimated to contribute only 10 to 20 percent of the NAAQS limit level. GRA

N81-13546# SRI International Corp., Menlo Park, Calif.

NUMERICAL STUDY OF LOCAL/REGIONAL ATMOSPHERIC CHANGES CAUSED BY A LARGE SOLAR CENTRAL RECEIVER POWER PLANT Final Report, 29 Sep. 1978 - 31 May 1980

Chandrakant M. Bhumralkar, Arthur J. Slemmons, and Kenneth C. Nitz May 1980 72 p refs
(Contract DE-AT03-76ET-20537)
(DOE/ET-20537/1) Avail: NTIS HC A04/MF A01

A two dimensional, vertical cross section, numerical atmospheric mesoscale model applied to study the potential atmospheric effects of the installation of a 100 MW/sub e/solar thermal central receiver power plant at Barstow, California. The results for typical summer conditions at Barstow and the surrounding region show that the power plant has the potential to increase local humidity and wind circulation but cannot induce the formation of clouds or rain. The results for typical summer conditions show that the solar power plant has the potential to increase the wind circulation and to form clouds and rain. However, the life cycle of such formations is only 2 to 3 hours. The results for typical winter conditions do not indicate significant atmospheric perturbations. The atmospheric effects of a dry cooling tower located upwind are not as significant and intense as those produced using a wet cooling tower. The effect of a wet cooling tower located at the downwind edge of the power plant is an increase in humidity in the downwind portion of the model atmosphere. DOE

N81-13547# Midwest Research Inst., Golden, Colo.
ENVIRONMENTAL ASPECTS OF SOLAR ENERGY TECHNOLOGIES
Carl L. Strojan Sep. 1980 21 p refs Presented at the Symp. on Energy and Ecology in the West, Tucson, Ariz., 3-8 Aug. 1980
(Contracts DE-AC02-77CH-00178; EG-77-C-01-4042)
(SERI/TP-743-826; CONF-800867-2) Avail: NTIS HC A02/MF A01

Solar energy technologies have environmental effects, and these may be positive or negative compared with current ways of producing energy. In this respect, solar energy technologies are no different from other energy systems. Where solar energy technologies differ is that no unresolvable technological problems (e.g., CO2 emissions) or sociopolitical barriers (e.g., waste disposal, catastrophic accidents) were identified. Some of the environmental aspects of solar energy technologies and ongoing research designed to identify and resolve potential environmental concerns are reviewed. It is important to continue research and assessment of environmental aspects of solar energy to ensure that unanticipated problems do not arise. It is also important that the knowledge gained through such environmental research be incorporated into technology development programs and policy initiatives. DOE

N81-13548# Department of Energy, Washington, D. C. Office of Health and Environmental Research.
SUMMARY OF THE CARBON DIOXIDE EFFECTS RESEARCH AND ASSESSMENT PROGRAM
Jul. 1980 34 p refs
(DOE/EV-T0002/1) Avail: NTIS HC A03/MF A01

A brief management-oriented summary is presented. Goals, strategies, selected facts and predictions are presented. DOE

N81-13549# Argonne National Lab., Ill.
ENVIRONMENTAL ASSESSMENT FOR THE SATELLITE POWER SYSTEM (SPS) CONCEPT DEVELOPMENT AND EVALUATION PROGRAM (CDEP)
Anthony R. Valentino Aug. 1980 128 p refs
(Contract W-31-109-eng-38)
(DOE/ER-0069) Avail: NTIS HC A07/MF A01

In the satellite power system (SPS), satellite in geosynchronous Earth orbit would collect solar energy in space, convert it to microwaves, and transmit the microwaves to receiving antennas (rectennas) on earth. At the rectennas, the microwave energy would be converted to electricity. This SPS environmental assessment considers the microwave and nonmicrowave effects on the terrestrial environmental and human health, atmospheric effects, and effects on electromagentic systems. No environmental problem was identified that would preclude the continued study of SPS technology. To increase the certainty of the assessment, some research was initiated and long-term research is being planned. DOE

N81-13550# Sandia Labs., Albuquerque, N. Mex.
ENVIRONMENTAL STUDIES DATA BASE: DEVELOPMENT AND DATA SYNTHESIS ACTIVITIES OF THE U.S. SUBSEABED DISPOSAL PROGRAM
L. S. Gomez, R. R. Hessler, D. W. Jackson, M. G. Marietta, K. L. Smith, Jr., and A. A. Yayanos 1980 25 p refs Presented at the Intern. Symp. on the Impacts of Radionuclide Releases into the Marine Environ., Vienna, 6-10 Oct. 1980 Prepared in cooperation with California Univ., La Jolla and Concepts Development, Inc., Albuquerque, N. Mex.
(SAND-80-2096C; CONF-801063-3; IAEA-SM-248/142) Avail: NTIS HC A02/MF A01

The scientific feasibility of subseabed emplacement of high-level nuclear wastes was studied. Studies of disposal methods and of the barriers to radionuclide migration (canister, waste form and sediment) suggest that environmental information is needed to address the impact of accidental release of radionuclides in the deep sea. Biological, physical and geochemical data were collected from field and laboratory studies as well as from literature searches. These data were analyzed using a multicompartmental radionuclide transport model and appropriate physical oceanographic models. The data integrated into this framework will help determine the environmental effects of radionuclides which may be released in the deep sea, and the effects of such a release upon man. Author

N81-13551# GEOMET, Inc., Gaithersburg, Md.
A LIDAR STUDY OF STABLE PLUME DISPERSION CHARACTERISTICS Final Report
Robert C. Koch, Benjamin Fliegner, Harry E. Rector, and John T. Schakenbach Mar. 1980 68 p refs Sponsored in part by Maryland Dept. of Natural Resources
(PB80-211071; GEOMET-ES-801-F; PPSP-MP-31) Avail: NTIS HC A04/MF A01 CSCL 13B

The plume observations were made with a 100 kilowatt peak power, 500 Hertz pulsed nitrogen laser system. During 35 nights the plume from the Dickerson power plant, located about 40 km northwest of Washington, D.C. on the Potomac River, was observed. Meteorological conditions are characterized by surface observations at the plant and at Dulles Airport and by balloon soundings taken hourly at the plant site during the period of lidar observations. GRA

N81-13552# GEOMET, Inc., Gaithersburg, Md.
A LIDAR STUDY OF STABLE PLUME DISPERSION CHARACTERISTICS, APPENDICES
Robert C. Koch, Benjamin Fliegner, Harry E. Rector, and John T. Schakenbach Mar. 1980 457 p refs Sponsored in part by Maryland Dept. of Natural Resources
(PB80-211089; GEOMET-ES-801-App) Avail: NTIS HC A20/MF A01 CSCL 13B

The results of a field monitoring program which was undertaken to observe the amount of air pollution a power plant can emit during stable night time conditions are presented. GRA

N81-13553# Performance Development Inst., Washington, D.C.
INCENTIVES FOR TECHNOLOGICAL INNOVATION IN AIR POLLUTION REDUCTION: AN ETIP POLICY RESEARCH SERIES. VOLUME 3: OPPORTUNITIES FOR INNOVATION. ADMIN ISTRATION OF SECTIONS 111(J) AND 113(D) (4) OF THE CLEAN AIR ACT AND INDUSTRY'S DEVELOPMENT OF INNOVATIVE CONTROL TECHNOLOGY Final Report
Jay Evans Apr. 1980 107 p
(Contract NBS-78-3603)
(PB80-205024; NBS-GCR-ETIP-80-88) Avail: NTIS HC A06/MF A01 CSCL 13B

The incentives are intended to induce industry to risk development of better air pollution control technology without the fear of prosecution or penalties for emissions violations expected during the debugging of innovative technology. Review of legislation and statutory requirements, review of the administration of these sections as reported by EPA and regulated companies, summary and observations resulting from these reviews, and a detailed case study of one Section 111(j) waiver application. GRA

N81-13554# Performance Development Inst., Washington, D.C.
INCENTIVES FOR TECHNOLOGICAL INNOVATION IN AIR POLLUTION REDUCTION: AN ETIP POLICY RESEARCH SERIES. VOLUME 5: AN ANNOTATED BIBLIOGRAPHY OF LITERATURE ON MARKET MECHANISMS AND ECONOMIC INCENTIVES FOR ENVIRONMENTAL REGULATION Final Report
Steve Watson Apr. 1980 32 p refs
(Contract NBS-78-3603)
(PB80-205610; NBS-GCR-ETIP-80-90) Avail: NTIS HC A03/MF A01 CSCL 13B

This bibliography cites and annotates literature regarding market mechanisms and economic incentives for environmental regulation. References emphasize air pollution and stationary source regulation. Primary attention is given to regulatory tactics that could entail internal or external trading in emission reductions, such as emission fees are included but not emphasized. Scholarly literature as well as government reports, and articles from other sources are included in the bibliography. Author

N81-13555# Environmental Protection Agency, Las Vegas, Nev. Office of Research and Development.
THE RAPS (REGIONAL AIR POLLUTION STUDY) HELICOPTER AIR POLLUTION MEASUREMENT PROGRAM, ST. LOUIS, MISSOURI Final Report, 1974 - 1976

David T. Mage, Roy B. Evans, Charles Fitzsimmons, Norman Hester, Frank Johnson, Steve Pierett, George Siple, and Robert Snelling Dec. 1979 208 p refs
(PB80-213119; EPA-600/4-79-078) Avail: NTIS HC A10/MF A01 CSCL 13B

This research program was initiated with the overall objective of providing measurement of air pollution and temperature gradient over the St. Louis, Missouri/Illinois, metropolitan area to complement surface measurements of air pollution by the Regional Air Monitoring System (RAMS) of the Regional Air Pollution Study (RAPS). The helicopter data collection program is described in detail and the missions flown by date, time, flight pattern and purpose are cataloged. These data, collected on magnetic tape, are deposited in the RAPS data bank maintained by the U.S. Environmental Protection Agency. Sufficient examples are provided, with figures and tables, to enable the prospective users of these data to understand the measurements and their limitations and to facilitate usage of the data bank. GRA

N81-13556# Environmental Protection Agency, Research Triangle Park, N.C. Monitoring and Data Analysis Div.
NATIONAL EMISSIONS REPORT, NATIONAL EMISSIONS DATA SYSTEM OF THE AEROMETRIC AND EMISSIONS REPORTING SYSTEM Annual Report
Mar. 1980 437 p
(PB80-222532; EPA-450/4-80-005) Avail: NTIS HC A19/MF A01 CSCL 13B

Annual cumulative estimates of source emissions of five criteria pollutants are presented: particulates; sulfur oxides; nitrogen oxides; hydrocarbons; and carbon monoxide. Summary data are presented for the nation as a whole, for individual states, and for Air Quality Control Regions and individual interstate portions thereof. GRA

N81-13557# PEDCo-Environmental, Inc., Durham, N.C.
PROGRAM TO PREVENT THE SIGNIFICANT DETERIORATION OF CARBON MONOXIDE, OZONE, HYDROCARBONS, NITROGEN DIOXIDE, AND LEAD Interim Report
David R. Dunbar and Roy A. Paul Mar. 1980 718 p refs
(Contract EPA-68-01-4147)
(PB80-221260; EPA-450/2-80-071) Avail: NTIS HC A99/MF A01 CSCL 13B

Various alternatives for implementing the program were identified and evaluated. A number of issues which need to be resolved in order for the program to be effectively carried out are described in detail. Various sources to be affected by the program were identified. The impact in terms of potential growth which may be precluded as a result of the program was assessed. An assessment of the potential consequences of no further regulatory action for the program is presented. GRA

N81-13558# Battelle Columbus Labs., Ohio.
PRELIMINARY ENVIRONMENTAL ASSESSMENT OF AFTERBURNER COMBUSTION SYSTEMS Final Report, Mar. 1977 - Jun. 1980
Richard E. Barrett and Phillip R. Sticksel, Jr. Jun. 1980 125 p
(Contract EPA-68-02-2629)
(PB80-215734; IERL-RTP-1081; EPA-600/7-80-153) Avail: NTIS HC A06/MF A01 CSCL 13B

The efficiency of fume incinerators was investigated. Available data and literature were reviewed and a subsequent experimental program, consisting of laboratory and/or field emission measurements to provide data not presently available was planned. The use of existing data to estimate the potential national usage of afterburners based on emissions is described. Field tests data from the files on one local air pollution control agency are evaluated. Results of the analyses show that the average efficiency of in-service afterburners may be significantly less than that reported in much of the literature. GRA

N81-13559# Southern Research Inst., Birmingham, Ala.
ASSESSMENT OF DIESEL PARTICULATE CONTROL: PARTICLE SIZE MEASUREMENTS Final Report, Nov. 1978 - Nov. 1979
Joseph D. McCain and M. Gregory Faulkner Dec. 1979 26 p refs
(Contract EPA-68-02-2610)
(PB80-224256; SORI-EAS-79-778; EPA-600/7-79-232C) Avail: NTIS HC A03/MF A01 CSCL 13B

Results of tests on an Oldsmobile 98 diesel automobile obtain data on parameters typical of a light duty vehicle are reported. Data are presented for operations under four simulated driving conditions. The increasing appearance of the diesel engine on the passenger car market had led to concern over particulate emissions (smoke) from these engines. Possible control strategies involving particulate collection in the hot exhaust stream requires knowledge of the concentrations and size distributions of the particulate matter at exhaust conditions. GRA

N81-13560# Wisconsin Univ. - Madison. Dept. of Mechanical Engineering.
AIR POLLUTION STUDIES NEAR A COAL-FIRED POWER PLANT: WISCONSIN POWER PLANT IMPACT STUDY Final Report, Jul. 1975 - Jul. 1978
Kenneth W. Ragland, Bradley D. Goodell, and Terry L. Coughlin May 1980 117 p refs Prepared in cooperation with Wisconsin Public Service Corp., Green Bay, Wis.
(Grant EPA-R-803971)
(PB80-205792; EPA-600/3-80-048) Avail: NTIS HC A06/MF A01 CSCL 13B

Concentrations of dry deposition of sulfur dioxide were investigated near a new 540-MW coal-fired generating station located in a rural area 25 miles north of Madison, Wisconsin. Monitoring data for 2 years before the start-up in July 1975 and for the year 1976 were used to assess the impact of the plume and to investigate the hourly performance of the Gaussian plume model. GRA

N81-13561 Indiana State Univ., Terre Haute.
THE PHYSICAL NATURE OF THE INTERFACE AS A FACTOR IN URBAN CLIMATE Ph.D. Thesis
Samuel Nickerson Goward 1979 316 p
Avail: Univ. Microfilms Order No. 8029169

The energy budget approach was used to extract the physical properties of the interface and contrast urban and rural interface physical conditions. Quantitative values for each interface physical property were compiled for representative urban and rural interface materials. A numerical simulation model of the relation between the net radiation budget and surface thermal response was developed and used to study the impact of varying each interface physical property. To confirm the results from energy budget analysis, remote sensor data of the Indianapolis, Indiana, urban interface were analyzed. Digital computer analysis procedures were used to extract high resolution spatial measurements of albedo and surface temperatures from the data. The measurements were examined statistically to verify the results derived through the energy budget analysis. Analysis of the remote sensor data confirmed the findings from the energy budget approach. Dissert. Abstr.

N81-13562 Texas Univ. at Dallas.
A METHODOLOGY FOR EMISSION SOURCE SAMPLING BASED UPON VOLUMETRIC FLOW ANALYSIS Ph.D. Thesis
Philip Douglas Baumann 1980 67 p
Avail: Univ. Microfilms Order No. 8028546

An analysis was made of volumetric flow rates within circular ducts (stacks) to determine velocity profiles for laminar and turbulent flow regimes. A model was developed utilizing the velocity profile equation of Nikuradse. The model calculates equal annular volumes within a circular duct so that sampling points may be located so as to be representative of equal volumes rather than equal areas. A comparison was made between the Volumetric Method and the Environmental Protection Agency's Reference Method of Title 40, Code of Federal Regulations, Part 60. A determination was made that for specific flow regimes within certain Reynolds number ranges the Volumetric Method is more accurate than the EPA Method 1. A determination was also made that for source sampling with one point location methodology for all flow regimes, the current EPA Method 1 produces acceptable results and its use for emission source sampling of air pollutants is within the systematic and statistical errors of the source sampling methodology and is therefore appropriate. Dissert. Abstr.

N81-13563 Colorado State Univ., Fort Collins.
APPLICATIONS OF STRIPPING ANALYSIS TO METAL DETERMINATIONS IN NATURAL WATERS Ph.D. Thesis
Joseph Edward Bonelli 1980 183 p
Avail: Univ. Microfilms Order No. 8028725

The electroanalytical technique of differential pulse anodic stripping voltammetry was applied to ultratrace metals determinations in natural waters. Analytical methods for the simultaneous multielement determination of zinc, cadmium, lead, and copper, and for the determination of thallium in natural waters are presented. The methods were optimized for their specific intended applications, evaluated, and applied to ultratrace metals determinations in a variety of natural water samples. Interference effects due to intermetallic compound formation, variations in acidity, and unresolved oxidation processes were evaluated and minimized. A positive interference on copper determinations due to iron was identified and characterized. A simple, experimental compensation technique for this latter interference effect was devised and applied to copper determination in a river water sample. The methods are shown to be at least equivalent in accuracy, precision, and sensitivity to other popular trace analysis techniques. Dissert. Abstr.

N81-13564 Indiana State Univ., Terre Haute.
INDUSTRIAL AIR POLLUTION AND SOCIOECONOMIC RESIDENTIAL PATTERNS: A CASE STUDY Ph.D. Thesis
Stephen John Stadler 1979 195 p
Avail: Univ. Microfilms Order No. 8029194

Two hypotheses were presented: first, that low socioeconomic status was spatially coincident with high levels of industrial air pollution; second, that industrial air pollution patterns produced by atmospheric conditions unfavorable for the dispersal of pollutants were more closely related to socioeconomic residential patterns than were industrial air pollution patterns produced by annual conditions. Industrial air pollution values were generated for eleven sets of conditions representing variations of atmospheric stability, wind directions, and seasons. Low socioeconomic status was generally associated with high levels of industrial air pollution. Unlike previous studies, black residential neighborhoods were not associated with the zones of highest air pollution. Different strengths of relationships were found for each of the eleven sets of conditions; overall, the relationships involving stable, summer, south quadrant wind, and west quadrant wind conditions were stronger than those for annual conditions. Dissert. Abstr.

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N81-13565 Washington Univ., Seattle.
THE OPTICAL ABSORPTION PROPERTIES OF SUSPENDED PARTICLES IN THE LOWER TROPOSPHERE AT VISIBLE WAVELENGTHS Ph.D. Thesis
Ray Earl Weiss 1980 189 p
Avail: Univ. Microfilms Order No. 8026327

A method for measuring the optical extinction coefficient for absorption, the Integrating Plate Method (IPM), was validated in laboratory and field tests. The absorption cross sections for single sized particles of methylene blue, large enough to the opaque, were compared with calculated cross sections for particles of the same size. Field tests were conducted to compare extinction as measured by long path transphotometry to combined measurements of light scattering and absorption extinction, using an integrating nephelometer and the Integrating Plate Method. Light absorption extinction coefficients, the albedo for single scattering and several related optical and physical aerosol properties was measured and tabulated for seventeen sites in the United States and one site in the Soviet Union. The chemical nature of the absorbing material was investigated. Chemical extraction experiments were performed on the filters containing aerosol particles to determine the resistance of the absorbing material to removal with various strong acids and oxidizing agents. Dissert. Abstr.

N81-13566 Illinois Univ. at Urbana-Champaign.
THE OBJECTIVE ANALYSIS OF PRESTORM MESOSCALE RAWINSONDE DATA THROUGH THE IMPOSITION OF DYNAMICAL CONSTRAINTS Ph.D. Thesis
Stephen Campbell Bloom 1980 114 p
Avail: Univ. Microfilms Order No. 8026456

The mesoscales structures of two cases chosen from the National Severe Storms Laboratory (NSSL) archives were investigated. Severe weather developed only in the June case, whereas conditions initially appeared to be favorable for the development of severe weather for both cases. Rawinsonde launches, with temporal and approximate horizontal spacings of 90 min and 80 km respectively, from the NSSL mesoscale network provided data which were interpolated objectively onto a regular space time grid. Only prestorm data were used in these analyses. A set of approximate momentum equations were used for the computational of momentum budgets using the interpolated data. The residuals obtained from the budget calculations are unrealistically large, indicating that the interpolated data are not dynamically consistent with the budget equations. A variational adjustment process was developed whereby the interpolated winds and geopotential are adjusted (in time and on horizontal planes) in a least squares sense subject to the dynamical constraints of the momentum equations used for the budget calculations.
Dissert. Abstr.

N81-13567*# National Aeronautics and Space Administration, Washington, D. C.
PHYSICS OF THE ATMOSPHERE: RESPONSE OF THE WATER VAPOR CHANNEL OF THE METEOSAT SATELLITE
M. Roulleau (Ecole Polytechnique, Palaiseau, France), M. M. Poc (Ecole Polytechnique, Palaiseau, France), N. Scott (Ecole Polytechnique, Palaiseau, France), and A. Chedin (Ecole Polytechnique, Palaiseau, France) Jul. 1980 8 p refs Transl. into ENGLISH from Compt. Rend., ser. b, Sci. Phys., v. 289, no. 16, Paris, 17 Dec. 1979 p 325-328 Transl. into ENGLISH by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75836) Avail: NTIS HC A02/MF A01 CSCL 04A

An accurate model of the atmospheric transmission function is used to obtain the relationship between the cloudless radiances measured by the 6-7 microns Meteosat radiometer (water vapor channel) and the numerical parameters associated to each point of an image. This relationship is compared to the temporary calibration curve published by the European Space Agency.
Author

N81-13568*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TABULATIONS OF AMBIENT OZONE DATA OBTAINED BY GASP AIRLINERS, MARCH 1975 TO DECEMBER 1977
Gregory D. Nastrom (Control Data Corp., Minneapolis) and James D. Holdeman Sep. 1980 111 p refs
(Contract DOT-FA78WAI-893)
(NASA-TM-81528; E-481; FAA-EE-43) Avail: NTIS HC A06/MF A01 CSCL 04A

Tabulations are given of GASP ambient ozone mean, standard deviation, median, 84th percentile, and 98th percentile values, by season, flight level, and geographical region. In addition, selected empirical probability variations are highlighted to illustrate the types of curves which might be appropriate in specific analyses of the tabulated data, and an example-case calculation is presented to illustrate how the tables can be used to estimate the frequency of commerical airline flights encountering high cabin ozone levels. Author

N81-13569*# National Aeronautics and Space Administration, Washington, D. C.
MODEL FORECASTS AND WORLD OBSERVATIONS OF THE OZONE LAYER, 1960 - 1980
Nov. 1980 42 p refs Transl. into ENGLISH of "Previsions des modeles et observations mondiales de la Couche d'Ozone (1960-1980)" Proj. OLDE/CFC, France, 1980 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76444) Avail: NTIS HC A03/MF A01 CSCL 04A

Theoretical and actual measurements of the decrease in global ozone are presented. S.F.

N81-13570# Panametrics, Inc., Waltham, Mass.
BETASONDE 2, A ROCKET BORNE PROBE FOR ATMOSPHERIC DENSITY MEASUREMENT IN THE MIDDLE ATMOSPHERE Final Report, 1 May 1976 - 30 Sep. 1979
Bach Sellers and Jean L. Hunerwadel Sep. 1980 47 p refs
(Contract DAAG29-76-C-0041)
(AD-A090788; PANA-AIR-5; ARO-13870.1-GS) Avail: NTIS HC A03/MF A01 CSCL 04/1

A density gauge for use in the 20-90 km range of the atmosphere has been designed and fabricated. It is based on beta-ray forward scattering and uses a Pm-147 beta source. Estimated accuracy is plus or minus 6% or better for launch on na Arcas having apogee near 90 km. The flight model is now ready for integration into a rocket sonde. A flight program for the sonde is recommended, and techniques offering potential for application of the method up to 100 km are discussed. GRA

N81-13571# SRI International Corp., Menlo Park, Calif.
***SPECTRAL CHARACTERISTICS OF MEDIUM SCALE EQUATORIAL F-REGION IRREGULARITIES* Topical Report, 1 Jan. - 29 Feb. 1980**
Robert C. Livingston and Charles L. Rino Mar. 1980 37 p refs
(Contract DNA001-80-C-0077; DNA Proj. NWET-I25aaxhx640)
(AD-A091169; DNA-5311-T) Avail: NTIS HC A03/MF A01 CSCL 04/1

The spectral characteristics of equatorial F-region irregularities with scale sizes from a few kilometers to several hundred kilometers have been measured using data from the Atmospheric Explorer-E (AE-E) satellite. The spectra admit the expected power-law characterization with a mean spectral index slightly less than 2. The spectral index, p1, however, decreases with increasing perturbation strength. The same data have been compared with nearly simultaneous phase scintillation data from the Wideband satellite. The power-law index of the phase scintillation data varies with perturbation strength in exactly the same manner as does p1. With realistic propagation model parameters, the scintillations-inferred perturbation levels can be made to match those measured in-situ. However, the long-accepted unity separation between the in-situ and phase spectral indices is not observed. This discrepancy is attributed either to shortcomings in the theory or to lack of temporal/spatial comparability of the two measurements. GRA

N81-13572*# Stanford Univ., Calif. Inst. for Plasma Research.
POSSIBLE INFLUENCE OF SOLAR ROTATION ON TROPOSPHERIC CIRCULATION
John M. Wilcox Sep. 1980 20 p refs Presented at the Sun and Climate Conf., Toulouse, 30 Sep. - 3 Oct. 1980
(Contract NAS5-24420; Grant NGR-05-020-559; Contract N00014-76-C-0207; Grant NSF ATM-77-20580)
(NASA-CR-163819; AD-A091128; SU-IPR-818)
HC A02/MF A01 CSCL 03/2

A large-scale structure observed in the photospheric magnetic field is carried out into the helicopter by the solar wind. At Earth the resulting interplanetary magnetic field has polarity away from the sun for several consecutive days followed by an abrupt reversal and several days with field polarity toward the sun. This section structure appears to be related to some effects in the tropospheric circulation. GRA

N81-13573# Rome Air Development Center, Griffiss AFB, N.Y.
***VLF/LF REFLECTIVITY OF THE POLAR IONOSPHERE* Topical Report, 6 May - 1 Sep. 1979**
Robert P. Pagliarulo, John P. Turtle, John E. Rasmussen, Robert L. Cooley, and Wayne I. Klemetti Jan. 1980 86 p refs
(AF Proj. 4600)
(AD-A091091; RADC-TR-80-12) Avail: NTIS HC A05/MF A01 CSCL 20/14

This report provides a summary of high latitude ionospheric reflectivity as observed by the USAF high resolution VLF/LF ionosounder operating in northern Greenland. Ionospheric reflectivity parameters, including reflection heights and coefficients, are presented as a function of time of day. Measurements of polar propagation environment by a magnetometer and a riometer are presented as supplementary data. GRA

N81-13574# Tata Energy Research Inst., Bombay (India).
SOLAR RADIATION ON INCLINED SURFACES
May 1980 82 p refs
(NP-25081) Avail: NTIS HC A05/MF A01

Mean monthly values of daily shortwave radiation on inclined surfaces are presented for 13 locations in India. Values of direct, diffuse sky, reflected, and total shortwave radiation incident on an inclined surface are given for 9 slope angles (measured from the horizontal) and 8 aspects. All the data are computed using measured values of the total shortwave radiation on a horizontal surface according to the techniques described. Maximum and minimum values of direct solar radiation during each month are underlined and marked by asterisk respectively. Actual and potential users of radiation data, particularly those in the fields of agriculture, horticulture, forestry, architecture, heating and ventilating engineering, and photovoltaic systems, it is hoped, would find this publication useful in planning and designing of solar radiation devices. DOE

N81-13575# Massachusetts Inst. of Tech., Cambridge.
SEISMOLOGICAL INVESTIGATION OF CRACK FORMATION IN HYDRAULIC ROCK FRACTURING EXPERIMENTS AND IN NATURAL GEOTHERMAL ENVIRONMENTS Progress Report, 1 Sep. 1979 - 31 Aug. 1980
Keiiti Aki Sep. 1980 93 p refs
(Contract DE-AS02-76ER-02634)
(DOE/ER-02534/6) Avail: NTIS HC A05/MF A01

Seismic experiments, attenuation of high frequency shear waves in the lithosphere, a new kinematic source model for deep volcanic tremors, ground motion in the near-field of a fluid-driven crack and its interpretation in the study of shallow volcanic tremore, low velocity bodies under geothermal areas are described. Events on Mt. St. Helens and Newberry Peak are included. DOE

N81-13576# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e. V., Garmisch-- Partenkirchen (West Germany). Inst. Fuer Atmosphaerische Unmweltforschung.
***BALANCE OF THE TROPOSPHERIC OZONE AND ITS* RELATION TO STRATOSPHERIC INTRUSIONS INDICATED BY COSMOGENIC RADIONUCLIDES *Technical Progress* Report, 1 Nov. 1979 - 30 Jun. 1980**
R. Reiter, H. J. Kanter, R. Sladkovic, H. Jaeger, and K. H. Munzert Jul. 1980 52 p refs
(Contract DE-AC02-76EV-03425)
(DOE/ET-03425/19) Avail: NTIS HC A04/MF A01

The balance of the tropospheric ozone is investigated considering the ozone sources with emphasis on tropospheric pollutants and stratospheric-tropospheric exchange processes. The measuring series of ozone concentration obtained at three different levels of the boundary layer were analyzed. Data were evaluated in correlation with relevant meteorological parameters, for instance solar radiation. At the mountain stations, influx of stratospheric ozone prevails. In the valley, photochemical production is the main source. Ozone profiles obtained by balloon sondes revealed that as a rule after solar flares associated with Forsbush effect drastic changes of the ozone profile take place in the lower stratosphere. Then, extremely high maxima of the ozone partial pressure are observed immediately above the tropopuase and also intensive influxes of tropospheric air into the stratosphere. DOE

N81-13577# Northrop Services, Inc., Huntsville, Ala.
SITE INSOLATION AND WIND POWER CHARACTERISTICS, NORTHEAST REGION, VOL. 2
Roger E. Bray Aug. 1980 104 p refs
(Contracts DE-AC01-77ET-20160; EG-77-C-01-4016)
(DOE/CS-20160/01) Avail: NTIS HC A06/MF A01

Historic data (SOLMIET), at 8 National Weather Service stations with hourly solar insolation and collateral meteorological information, were interrogated to provide an estimate of future trends. Solar data are global radiation incident on a horizontal surface, and wind data represent wind power normal to the air flow. Selected insolation and wind power conditions were

investigated for their occurrences and persistance for defined periods of time, on a monthly basis. Global horizontal insolation are related to inclined surfaces at each site. Ratios are provided, monthly, for multiplying global insolation to obtain insolation estimates on southfacing surfaces inclined at different angles with respect to the horizontal. DOE

N81-13578# Texas A&M Univ., College Station. Dept. of Agricultural Engineering.

OPTIMAL USE OF GROUNDWATER AND SURFACE WATER TO REDUCE LAND SUBSIDENCE Technical Completion Report, 1 Jul. 1976 - 31 Dec. 1978

Gilberto Acosta-Gonzalez and Donald L. Reddell Dec. 1978 238 p refs Sponsored in part by Office of Water Research and Technology, Washington, D.C.

(Contracts DI-14-34-0001-7091; DI-14-34-0001-7092; DI-14-34-0001-8046; DI-14-34-0001-9046)

(PB80-220338; W80-06331; TR-103; OWRT-A-038-TEX(1)) Avail: NTIS HC A11/MF A01 CSCL 08G

An optimization model was developed to allocated surface and groundwater resources under various water management policies which might be implemented to control land-surface subsidence. This model allocated the water resources of a region so that the overall cost of water development and land-surface subsidence was minimized. To use this model, a hydrologic model was developed to predict the piezometric heads in sand and clay layers caused by groundwater pumpage. A compaction, or subsidence model, used the resulting piezometric heads from the hydrologic model to predict land-surface susidence. A linear programming model was then developed to optimally allocate ground and surface water resources within a region so that the cost of water and land subsidence was minimized. GRA

N81-13579# Woods Hole Oceanographic Institution, Mass.

GEOTHERMAL PROCESSES AT THE GALAPAGOS SPREADING CENTER Ph.D. Thesis

Kenneth E. Green Aug. 1980 237 p refs

(Grants NSF OCE-77-28281; NSF OCE-77-23470; NSF OCE-75-23352)

(PB80-220247; WHOI-800-33) Avail: NTIS HC A11/MF A01 CSCL 08G

Measurements of the heat flow field of the Galapagos Spreading Center in an area of about 570 sq km revealed the planform of the conductive flux. This permitted an areal estimate of the near-axis flux for comparison with theoretical plate cooling models. GRA

N81-13580# Oregon State Univ., Corvallis. Water Resources Research Inst.

THE GEOCHEMICAL PARTITIONING AND BIOAVAILABILITY OF TRACE METALS IN MARINE SEDIMENTS Progress Report, 1 Oct. 1977 - 31 Sep. 1979

Stewart M. Oakley, Kenneth J. Williamson, and Peter O. Nelson 18 Jul. 1980 96 p refs

(OWRT Proj. A-044-ORE-W73)

(PB80-220205; WRRI-68; W80-06333; OWRT-A-044-ORE(1)) Avail: NTIS HC A05/MF A01 CSCL 08D

Trace metals in the aquatic environment are concentrated on solid geochemical phases which eventually become incorporated into estuarine and marine sediments. The mechanism of trace metal concentration is believed to be adsorption with various geochemical phases such as hydrous metal oxides, clays, and organic matter. Metals in estuarine of marine sediments can be expected to be partitioned between different phases, depending on the concentration of the phase and the strength of the adsorption bond. The bioavailability of sediment-bound metals to deposit-feeding organisms will depend on trace metal partitioning and the kinetics of biological metal uptake from each geochemical phase. Models for trace metal partitioning and bioavailability in marine sediments are included. GRA

N81-13581# Auburn Univ., Ala. Dept. of Geology.

PRELIMINARY EVALUATION OF AN ALTERNATE ELECTRODE ARRAY FOR USE IN SHALLOW SUBSURFACE ELECTRICAL RESISTIVITY STUDIES Completion Report, Mar. - Aug. 1975

Thomas J. Carrington and Don A. Watson Jul. 1980 37 p refs Prepared in Cooperation with Dixie Well Boring Co., Inc., LaGrange, Ga.

(Contract DI-14-34-0001-5001)

(PB80-220163; W80-06324; OWRT-A-046-ALA(1)) Avail: NTIS HC A03/MF A01 CSCL 08G

Laboratory and field research was conducted to evaluate several electrode arrays, as to their relative efficiency with regard to time and space requirements, and effectiveness in predicting subsurface conditions. Laboratory investigations were conducted by use of a table-top tray in which various materials could be placed to simulate a variety of vertical cross-section of subsurface conditions. Nine different electrode arrays were examined to select the most suitable for further trial under field conditions. The areas of superiority are defined as reliability of data under most conditions examined, speed of field use and straight-line distance required for a given test. GRA

N81-13582# Texas Univ. at Austin. Bureau of Economic Geology.

GEOLOGIC STUDIES OF GEOPRESSURED AND HYDROPRESSURED ZONES IN TEXAS Annual Report, Jan. 1979 - Jan. 1980

R. A. Morton, B. R. Weise, and A. R. Gregory 30 Jan. 1980 54 p refs

(Contract GRI-5011-321-0125)

(PB80-219611; GRI-79/0061) Avail: NTIS HC A04/MF A01 CSCL 08G

Zones were defined on the basis of pressure gradients and temperatures. High-sandstone corridors, corresponding to the trends of the Wilcox group and Frio Formation, were identified for the Geopressured and deep hydropressured zones. Five fairways, or areas of maximum sandstone, were located within the corridors. Areas most prospective for testing entrained methane resources in the shallow geopressured and deep hydropressured zones were identified in each fairway. GRA

N81-13583# International Geophysical Year World Data Center A, Boulder, Colo. National Geophysical and Solar-Terrestrial Data Center.

THE ALASKA IMS MERIDIAN CHAIN: MAGNETIC VARIATIONS Progress Report, 9 Mar. - 27 Apr. 1978

H. W. Kroehl, G. P. Kosinski, S.-I. Akasofu, G. J. Romick, C. E. Campbell, G. K. Corrick, C. E. Hornback, and A. M. Gray World Data Center A for Solar-Terrestrial Physics. Jun. 1980 116 p refs Prepared in cooperation with Alaska Univ., Fairbanks

(PB80-213820; UAG-75; NOAA-80071401) Avail: NTIS HC A06/MF A01 CSCL 04A

In support of the coordination aspects of the international Magnetospheric Study, the U.S. supported geomagnetic observations program of installing magnetometers, radio transmitters (for communications with SMS/GOES satellites) and/or magnetic tape recorders at 28 sites to complement/upgrade existing networks and facilities. The availability of data is indicated and the daily magnetic variations along the Alaska Chain and average magnetic variations along the Alaska Chain are charted. The appendix presents daily stack and polar plots of Alaska Chain magnetic variations (9 March-27 April 1978). GRA

N81-13584 Purdue Univ., Lafayette, Ind.

LITHOSPHERIC INTERPRETATION AND MODELING OF SATELLITE ELEVATION GRAVITY AND MAGNETIC ANOMALY DATA Ph.D. Thesis

Ralph Robert Benedikt vonFrese 1980 180 p Avail: Univ. Microfilms Order No. 8027347

To facilitate geologic interpretation of satellite elevation potential field data analysis techniques are developed and verified in the spherical domain that are commensurate with conventional flat Earth methods of potential field interpretation. A powerful approach to the spherical Earth problem relates potential field anomalies to a distribution of equivalent point sources by least squares matrix inversion. Linear transformation of the equivalent source field lead to corresponding geoidal anomalies, pseudoanomalies, vector anomaly components, spatial derivatives, continuations, and differential magnetic pole reductions. The procedures and results of this investigation provide a comprehensive approach to the lithospheric analysis of potential field anomalies in the spherical domain and, hence, have widespread application in the analysis and design of satellite gravity and magnetic surveys for geological investigation. Dissert. Abstr.

N81-13585 Columbia Univ., New York.
LARGE-AND MODERATE-SIZE EARTHQUAKES: THEIR RELATIONSHIP TO THE TECTONICS OF SUBDUCTION Ph.D. Thesis
William Richard McCann 1980 194 p
Avail: Univ. Microfilms Order No. 8023521

The likelihood of a region to be the site of a large earthquake in the near future (i.e., its seismic potential) can be estimated by considering not only the seismic history of the region but also the style of deformation along that segment of the plate boundary. A map summarizing six categories of seismic potential for the world's plate boundaries for the next few decades was constructed. These categories range from what are considered high to low potential for being the site of large earthquakes during that period of time. Analysis of the distribution of small earthquake along seismic zones may refine the determination of the seismic potential. Some space time patterns in the occurrence of small shocks may be forerunners of large earthquakes: identification of such patterns in a region of high seismic potential will allow intensified studies of the region. These studies may lead to a refinement in the estimates of the time of occurrence of the expected earthquake. Dissert. Abstr.

N81-13586 Virginia Polytechnic Inst. and State Univ., Blacksburg.
THE REFLECTED WAVEFORM OF A SPHERICAL SEISMIC WAVE Ph.D. Thesis
Paul Michael Krail 1980 143 p
Avail: Univ. Microfilms Order No. 8028149

In oil exploration, it is customary to analyze the seismic waves produced by a test explosion in terms of plane elastic waves interacting with plane homogeneous layers. The analysis is extended to spherical waves, using Sommerfeld's expansion of a spherical wave as a contour integral over plane waves and then obtaining the spherical reflection coefficient by integration over the (plane wave) Zoeppritz coefficient. The result is evaluated analytically by the method of steepest descent (following Brekhovskikh's treatment for the simpler case of fluid media). Computer plots comparing the spherical and plane wave coefficients vs. angle and material parameters are given. It is demonstrated that, when the source to receiver distance is comparable with the wavelength, the plane wave analysis can make an error in the velocity ratio of the order of 30%. With the new expression for the spherical reflection coefficient, both the magnitude and the phase of the reflected waveform depend substantively upon the properties of the media (whereas the phase information is discarded in the plane wave analysis).
Dissert. Abstr.

N81-13587 State Univ. of New York, Buffalo.
THE IMPACT OF VOLCANISM ON THE CHEMICAL COMPOSITION OF GREENLAND ICE SHEET PRECIPITATION Ph.D. Thesis
Michael Myrl Herron 1980 166 p
Avail: Univ. Microfilms Order No. 8027608

Major explosive volcanic eruptions have a dramatic impact on the impurity composition of Greenland precipitation. Concentrations of Zn, Cd, Cu, Pb, Na, K, Mg, Ca, Al, F-, Cl-, NO3 and SO4 were measured on ice core samples representing the 18 year period 1869-1886 and the three year period 1782-1784 with a sample resolution of about six per year. Concentration peaks for most of these species occur within one year of each known eruption, although the impact of each eruption varied for different species. A number of lines of evidence suggest that volcanism is the major source of Zn, Cd, Cu, and Pb in other Greenland strata even in years without major eruptions. Concentrations of many metals in Greenland ice and in remote area air and precipitation are fairly well accounted for on the basis of a simple mixture of continental dust and volcanic material which is enriched in certain elements above average crustal composition. This enrichment is shown to be related primarily to the metal's chalcophile affinity and secondarily to the volatility of the metal's halide compounds. Dissert. Abstr.

N81-13588 State Univ. of New York at Albany.
THEORETICAL AND COMPUTER ASSISTED STUDIES IN TECTONICS, STRUCTURAL GEOLOGY AND ISOTOPE DATING Ph.D. Thesis
Richard Leigh Thiessen 1980 500 p
Avail: Univ. Microfilms Order No. 8026968

Several problems in the fields of tectonics, structural geology and isotopic dating were examined and simplified using computer programs. These problems include the theory of refolding, refold applications to three mining areas, hotspots and their relationship to mantle convection systems and ionium dating of volcanic rocks. Various aspects of multiple generations of interfering folds were examined. The ideas of refold theory were applied to three mining areas, the Chisel Lake Ore Body of Manitoba, the Galena-Roubaix District of South Dakota and Montauban-les-Mines of Quebec. These three studies represent three different technqiues of identifying fold generations. Dissert. Abstr.

N81-13212*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ORION MOBILE UNIT DESIGN
D. L. Brunn, S. C. Wu, E. H. Thom, F. D. McLaughlin, and B. M. Sweetser *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 6-32 refs (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 08G

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N81-13589 Princeton Univ., N. J.
THE IMPACT OF ATMOSPHERIC NOISE ON THE DETECTION OF INTERANNUAL CLIMATE VARIABILITY: AN OBSERVATIONAL STUDY OF THE ATMOSPHERIC-OCEAN SYSTEM DURING 1963 - 1973 Ph.D. Thesis
Michael John Stefanick 1980 170 p
Avail: Univ. Microfilms Order No. 8027718

The horizontal and vertical scales of transient atmospheric disturbances are determined from the general circulation statistics. The time scale for these transients is estimated by comparing the daily and monthly variances for various quantities (including temperature, geopotential and wind). These space and time scales are used to estimate the sampling errors in spatial and time averages, which are due to these transients. From the localized nature of atmospheric disturbances a method of principal component analysis is developed which is least sensitive to atmospheric noise. This method is applied to the observed, monthly averaged, objectively analyzed fields for geopotential (at 1000 mb), surface temperature and air temperature. The least noise sensitive component for surface pressure is Walker's Southern Oscillation. A simple energy balance model for the mixed layer of the ocean is developed which relates the zonal gradients of surface pressure and temperature. This model is simple but it predicts interannual oscillations in tropical sea surface temperatures which have the largest amplitudes in the tropical eastern Pacific and concomitant oscillations in surface pressure of opposite sign in the eastern and western Pacific.
Dissert. Abstr.

N81-13590 Illinois Univ. at Urbana-Champaign.
THE EFFECT OF THE GUST FRONT ON THE GENERATION OF NEW CONVECTION Ph.D. Thesis
Ching-Sen Chen 1980 197 p
Avail: Univ. Microfilms Order No. 8026462

A three dimensional numerical cloud model was developed. The model was modified with a vertically stretched grid, a fourth order conservative approximation for horizontal advection, and an Orlanski type boundary condition. The sounding taken from the multicell Raymer storm that occurred in NHRE on 9 July 1973 is used as the initial environment in the model. Five new cells formed about 25-30 min apart due to the downdraft from the previous cell enhancing the convergence along the gust front. The formation of successive cells was apparently very sensitive to the amount of heat initially used to generate convection, but was not very sensitive to the type of heat source used to initialized convection. When the initial observed wind was altered by using only its north-south component successive cells still occurred. The successive formation of new cells was not sensitive to the

type of lateral boundary conditions used for calculating normal velocity. Dissert. Abstr.

N81-13591 Illinois Univ. at Urbana-Champaign.
THE RELATIONSHIP BETWEEN ORGANIZED CONVECTIVE SYSTEMS AND LARGE-SCALE FIELDS OBSERVED IN GATE
Ph.D. Thesis
Yi-Leng Chen 1980 156 p
Avail: Univ. Microfilms Order No. 8026464

Case studies for convective systems observed during the period from 3 September through 6 September 1974 are presented. The horizontal divergence was computed using an objective analysis scheme developed earlier by Ogura and Chen (1977). The vertical velocity was then computed kinematically from the mass conservation equation. The results indicated that the low level convergence and consequently upward motion was present or enhanced prior to the development of organized convective systems. A low level inversion was absent in the area of subsequent convective development in contrast to other areas having no convective activity. The relationships between the precipitation field and large scale circulation characterized by easterly waves, the surface confluence line and the cross equatorial flow was studied. The surface and upper air sounding data for all A/B and B scale ships for each phase of GATE were stratified according to the wave category defined by Reed and Recker (1971) before applying the objective analysis scheme. Dissert. Abstr.

N81-13592 Illinois Univ. at Urbana-Champaign.
PARTICLE CAPTURE BY EVAPORATING CLOUD DROPS
Ph.D. Thesis
Keng Hung Leong 1980 102 p
Avail: Univ. Microfilms Order No. 8026546

The capture efficiency was obtained experimentally near 30% relative humidity for cloud drops with solid spheroidal particles of manganese hypophosphite and near 90% relative humidity for drops with hollow shells of lithium carbonate. Good agreement with theory was found for the target particles scavenged by inertial impaction but not for smaller particles which are scavenged by phoretic forces. The results together with the review of available phoretic theories showed that slip flow theories for phoresis of an isolated particle in a uniform temperature gradient cannot be applied to the case of particle capture by evaporating drops. The data did not agree with the predicted variation of phoretic capture efficiency with particle size. The observed decrease of efficiency with particle size was not as strong as predicted by phoretic theory. The data showed increased efficiencies for particles with lower thermal conductivity which is consistent with the theoretical trend. Dissert. Abstr.

N81-13593*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DECONVOLUTION AND ANALYSIS OF WIDE-ANGLE LONGWAVE RADIATION DATA FROM NIMBUS 6 EARTH RADIATION BUDGET EXPERIMENT FOR THE FIRST YEAR
T. Dale Bess, Richard N. Green, and G. Louis Smith Dec. 1980 62 p refs
(NASA-TP-1746; L-13873) Avail: NTIS HC A04/MF A01 CSCL 04B

One year of longwave radiation data from July 1975 through June 1976 from the Nimbus 6 satellite Earth radiation budget experiment is analyzed by representing the radiation field by a spherical harmonic expansion. The data are from the wide field of view instrument. Contour maps of the longwave radiation field and spherical harmonic coefficients to degree 12 and order 12 are presented for a 12 month data period. Author

N81-13594# Meteorological Satellite Center, Tokyo (Japan).
METEOROLOGICAL SATELLITE CENTER, TECHNICAL NOTE NO. 1, 1980
Mar. 1980 123 p refs In ENGLISH and JAPANESE
Avail: NTIS HC A06/MF A01

Techniques utilized to process data acquired by meteorological satellites are described. Emphasis is placed on the accuracy and reliability of satellite wind and cloud data. For individual titles, see N81-13595 through N81-13600.

N81-13595# Meteorological Satellite Center, Tokyo (Japan).
THE EFFECTS OF DIFFERENT TIME INTERVALS ON THE WIND ESTIMATION
Hiroshi Yamashita and Kiyoshi Arai *In its* Meteorol. Satellite Center, Tech. Note No. 1, 1980 Mar. 1980 p 1-11 ref (For primary document see N81-13594 04-47)
Avail: NTIS HC A06/MF A01

The magnitude of the wind speed and the number of the data deduced from pictures obtained in different time interval are compared. It is revealed that wind speeds are little affected by the interval of pictures and the number of wind data is increased with time interval getting shorter. Author

N81-13596# Meteorological Satellite Center, Tokyo (Japan).
THE SIMPLIFIED MAPPING EQUATION BY VISSR IMAGE DATA FROM THE GEOSTATIONARY METEOROLOGICAL SATELLITE (MGS)
Taichi Takahashi and Kazuyasu Kato *In its* Meteorol. Satellite Center, Tech. Note No. 1, 1980 Mar. 1980 p 13-19 ref (For primary document see N81-13594 04-47)
Avail: NTIS HC A06/MF A01

A simplified mapping equation based on information such as a set of longitude-latitude values, VISSR display format, and specific values of spacecraft, which are easily obtained from satellite data is presented. The popular transformation is a linear interpolation equation for mapping the image data, but it is difficult to maintain a sufficient accuracy. The present mapping equation is defined as a transformation matrix to perform a mapping with reasonable accuracy. An error analysis is also investigated using actual data set. J.M.S.

N81-13597# Meteorological Satellite Center, Tokyo (Japan).
ANALYSIS OF TIROS OPERATIONAL VERTICAL SOUNDER (TOVS) DATA TRANSMITTED BY THE GLOBAL TELECOMMUNICATION SYSTEM (GTS)
Toshiro Kamiko *In its* Meteorol. Satellite Center, Tech. Note No. 1, 1980 Mar. 1980 P 21-31 refs In JAPANESE and ENGLISH (For primary document see N81-13594 04-47)
Avail: NTIS HC A06/MF A01

The TIROS-N sounding data processed by NESS and transmitted by the Global Telecommunication System are analyzed. The TIROS Operational Vertical Sounder (TOVS) data are compared to radiosonde data. It is shown that the TOVS data do not overcome the shortcomings suffered by the VTPR in the lower atmosphere and the tropopause. The map analysis using only TOVS data revealed that the data is very useful in the upper levels, however, there are inaccuracies which mislead the analysis in the lower levels where mesoscale wave is predominant. As for water vapor, TOVS data can not be treated in the same way as radiosonde data, as water vapor is considerably variable in space and time and TOVS water vapor is a representative value over an area. The suggestion for the future usage of TOVS channel data is that the data in image form for a certain channel, especially water vapor absorption should be exploited so mesoscale features can be detected. J.M.S.

N81-13598# Meteorological Satellite Center, Tokyo (Japan).
ON PRECISION OF WINDS EXTRACTED FROM EARTH DISK IMAGES TAKEN FROM GEOSTATIONARY SATELLITE
Tadaaki Hamada *In its* Meteorol. Satellite Center, Tech. Note No. 1, 1980 Mar. 1980 p 33-52 refs In JAPANESE and ENGLISH (For primary document see N81-13594 04-47)
Avail: NTIS HC A06/MF A01

A technqiue of estimating satellite wind vector was developed using images from ATS, SMS, and GOES. The precision of satellite wind data and the compatibility of these data with rawinsounde wind data was investigated. It is shown that the causes of error in satellite wind data are mismatching of cloud pattern or manual mistracking, misregistration, and improper height assignment. Comparisons of satellite wind data with rawinsonde wind data and the relationship of cloud displacement to ambient to ambient wind observed by an aircraft show that satellite wind data do not have any significant differences from wind data observed by balloons. It is indicated that satellite wind data are a valuable input to numerical prediction. J.M.S.

N81-13599# Meteorological Satellite Center, Tokyo (Japan).
MAN-MACHINE INTERACTIVE PROCESSING OF EXTRACTING CLOUD TOP HEIGHT AND CLOUD WIND DATA FROM THE GMS IMAGES
Nobuhiko Kodaira, Kazuyasu Kato, and Tadaaki Hamada *In its* Meteorol. Satellite Center, Tech. Note No. 1, 1980 Mar. 1980 p 59-78 refs (For primary document see N81-13594 04-47)
Avail: NTIS HC A06/MF A01

The GMS Cloud Wind Estimation System (CWES) and Cloud Top Height Estimation System (CTHES) are described stressing the man-machine interactive procedures. The meteorological information such as cloud drift winds, cloud top heights are extracted from image data from VISSR. The image data are displayed on a TV-screen of the IPC (Image Processing Console) to manipulate them for man machine interactive processing. In this processing, an analyst selects a target cloud on the TV-screen and inputs the needed information from IPC. The cloud drift winds are reformatted by computer into a WMO code form for teletype transmission to world-wide users twice a day within four hours after the observation. The cloud top heights are used for the production of nephanalysis chart which is sent to final users as facsimile chart four times a day. J.M.S.

N81-13600# Meteorological Satellite Center, Tokyo (Japan).
BRIEF DESCRIPTION FOR ERROR ESTIMATES OF SATELLITE WINDS DERIVED BY CWES SYSTEM
Tadaaki Hamada *In its* Meteorol. Satellite Center, Tech. Note No. 1, 1-80 Mar. 1980 p 79-83 refs (For primary document see N81-13594 04-47)
Avail: NTIS HC A06/MF A01

Error sources of satellite wind data derived from imagery are as follows: (1) tracking target clouds which do not move with air motion (wind); (2) error caused by wind derivation system (misalignment, mismatching, etc.); and (3) error caused by assigning improper heights. Errors of satellite wind data stated are discussed on the basis of investigating the resultant winds derived from GMS images. J.M.S.

N81-13601# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
WEATHER AND CURRENTS IN THE VICINITY OF 23 DEG N, 46 DEG W, NORTH ATLANTIC OCEAN
Peter Fleischer Sep. 1980 24 p refs
(AD-A090630; NORDA-TN-74) Avail: NTIS HC A02/MF A01 CSCL 04/2

This technical note is a review of climate, sea conditions, and currents in March at Deep Sea Drilling Project Site 395A. The site is located on the upper west flank of the Mid-Atlantic Ridge. Weather is favorable for hole re-entry and related operations. Frequencies of storms, high winds, high seas and low visibility are well below 5%. Normal surface current speeds are 0.34-0.66 kn; intermediate and bottom current speeds are 0.19-0.29 kn, with infrequent maximum speeds to 0.78 kn.GRA

N81-13602# Los Alamos Scientific Lab., N. Mex. Theoretical Applications Div.
SIMPLE MODEL FOR WIND FIELD COMPUTATION FROM SPARSE DATA
W. H. Lee 1980 6 p refs Presented at the ANS Intern. Conf., Washington, D.C., 17-21 Nov. 1980
(Contract W-7405-eng-36)
(LA-UR-80-1995) Avail: NTIS HC A02/MF A01

An initial attempt to carry out a simple numerical model that will interpolate and smooth the complete wind fields for an arbitrary planar region where only sparse wind data are available is summarized. The model contains four features: any arbitrary planar region can be treated; the measured wind data can be irregularly distributed in the region; part of the code can be applied to any function that has two independent variables; and irrotational flow is assumed in smoothing the stream function. DOE

N81-13603# National Weather Service, Salt Lake City, Utah. Western Region.
ANNUAL DATA AND VERIFICATION TABULATION: EASTERN AND CENTRAL NORTH PACIFIC TROPICAL CYCLONES, 1979
Emil B. Gunther Apr. 1980 23 p
(PB80-220486; NOAA-80061702; NOAA-TM-NWS-WR-150)
Avail: NTIS HC A02/MF A01 CSCL 04B

A table presents verification statistics for the 1979 season. Best track, initial position, and initial position errors are shown, as well as the tracks of the cyclones. GRA

N81-13604# National Weather Service, Salt Lake City, Utah.
PROBABILITY OF SEQUENCES OF WET AND DRY DAYS
Hazen H. Bedke Jun. 1980 14 p
(PB80-223340; NOAA-80071403; NOAA-NWS-WRCP-12)
Avail: NTIS HC A02/MF A01 CSCL 04B

Climatological forecasts of precipitation, given in terms of both absolute and transitional probabilities, are quite useful in day to day operations, as well as general precipitation climatology for any period of the year. These forecasts can be obtained directly from the referenced publication with minimal arithmetic; however, this program makes these data immediately available to the forecaster. This type of forecast is especially applicable for weather support to agriculture and forestry interests. GRA

N81-13605# National Meteorological Center, Washington, D. C.
EVALUATION OF TIROS-N DATA, JANUARY - JUNE, 1979
David Wright Jun. 1980 21 p
(PB80-220494; NOAA-80062305; NOAA-TM-NWS-NMC-65)
Avail: NTIS HC A02/MF A01 CSCL 04B

A brief history is given of the use of TIROS-N data in National Meteorological Center's analysis operations during the first half of 1979, together with comments on the quality of these data. The impact of TIROS-N data on the Southern Hemisphere component of NMC's analysis and prognoses is described. GRA

N81-13606# National Hurricane and Experimental Meteorology Lab., Coral Gables, Fla.
FLORIDA AREA CUMULUS EXPERIMENT (FACE) 1979: OPERATIONAL SUMMARY AND DATA INVENTORY
Jun. 1980 171 p refs
(PB80-223217; NOAA-80070704; NOAA-TM-ERL-NHEM L-7)
Avail: NTIS HC A08/MF A01 CSCL 04B

The confirmatory phase of the Florida Area Cumulus Experiment confirms that dynamic seeding was instrumental in increasing precipitation over a fixed target area. Randomized cloud seeding and other studies were conducted. The double blind nature of the experiment was continued and specified periods of experimentation, treatment and measurement were observed. Precipitation was estimated from radar after adjustment based on gage radar comparisons for an area covering 500 square kilometers. Additional rain gages were distributed over the target area to permit an independent assessment of the target rainfall. GRA

N81-13607# Environmental Monitoring and Support Lab., Research Triangle Park, N. C. Data Management and Analysis Div.
AN EVALUATION OF THE ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIALS) STANDARD METHOD FOR DETERMINING THE PERFORMANCE OF A WIND VANE
Peter L. Finkelstein Feb. 1980 77 p refs
(PB80-209141; EPA-600/4-80-028) Avail: NTIS HC A05/MF A01 CSCL 04B

The American Society for Testing and Materials (ASTM) proposed a standard method for testing the performance characteristics of a wind vane. The procedures used to test and evaluate the ASTM method, and the results of that evaluation are presented. Twelve wind vanes were borrowed from their manufacturers and tested using the ASTM procedures. The theory of wind vane dynamics is briefly reviewed. Description of the equipment and procedures used is given. Measurements of starting threshold, starting accuracy, delay distance, overshoot ratio, and damped wavelength were made. Damping ratio and natural wavelength were computed from the measurements. GRA

N81-13608# Texas A&M Univ., College Station. Dept. of Meteorology.
MESOSCALE CHARACTERISTICS OF THE TEXAS HIPLEX

AREA DURING SUMMER 1978 Final Report
Meta E. Sienkiewicz, James R. Scoggins, Steven F. Williams, and Myron L. Gerhard Apr. 1980 635 p refs
(Contracts DI-14-06-D-7587; TDWR-14-90026; TDWR-14-00003)
(PB80-211196; TDWR/LP-123) Avail: NTIS HC A99/MF A01 CSCL 04B

Mesoscale surface and upper air data obtained for the Texas HIPLEX area on 26 days are discussed. Rawinsonde soundings were made at 3 h intervals between 1500 and 0300 GMT on 17 of the 26 days at four sites, while surface data consisting of 10 min average values of temperature, humidity, pressure, and wind direction and speed were available from 20 stations for all 26 days. GRA

N81-13609 Purdue Univ., Lafayette, Ind.
THE AVAILABLE POTENTIAL ENERGY BUDGET OF A SEVERE STORM-PRODUCING EXTRATROPICAL CYCLONE Ph.D. Thesis
Song Chin Lin 1980 156 p
Avail: Univ. Microfilms Order No. 8027300

Grid scale and time mean flow available potential energy budget equations were derived. Computational analyses were carried out for both equations for a period (0000 GMT3 April-1200 GMT4 April 1974) spanning the life cycle of a severe storm producing extratropical cyclone which moved across the central United States. Among the diabatic heating components, total latent heat release and longwave radiation contribute significant positive and negative values, respectively, to the total diabatic heating. Total latent heat release is generally in good agreement with observed weather features and cyclone development. Grid scale available potential energy budget results show that, during the development of the extratropical cyclone, the available potential energy within the region under investigation is increased. Diabatic generation is a source of available potential energy, but its value is rather small when compared with other budget terms. Dissert. Abstr.

N81-13610 Utah Univ., Salt Lake City.
A NEW HORIZONTAL GRADIENT CONTINUOUS FLOW, ICE THERMAL DIFFUSION CHAMBER AND DETAILED OBSERVATION OF CONDENSATION-FREEZING AND DEPOSITION NUCLEATIONS Ph.D. Thesis
Edward Mason Tomlinson 1980 121 p
Avail: Univ. Microfilms Order No. 8022644

The chamber consists of preprocessing, main activation and ice crystal settling sections. A common top plate was used for all three sections and was held isothermal while a temperature gradient was maintained across the bottom plate of the main section. In the preprocessing and main sections, both plates were covered with ice. A new method was developed to smoothly coat ice on the plates. This configuration of the main section results in a nearly constant temperature horizontally in the direction across the sample flow, and produces a range of supersaturations. Heat pipes were utilized on the sides of the bottom plate to insure temperature uniformity along the direction of the flow. The sample air was sandwiched in the region of maximum supersaturation between layers of filtered and predried air so that the sample achieved a nearly constant supersaturation in the main section without transient supersaturations. The preprocessing section was held isothermal at the top plate temperature. Dissert. Abstr.

N81-13611 Colorado State Univ., Fort Collins.
BREAKUP OF TEMPERATURE INVERSIONS IN COLORADO MOUNTAIN VALLEYS Ph.D. Thesis
Charles David Whiteman 1980 269 p
Avail: Univ. Microfilms Order No. 8028771

Tethered balloon observations were made on clear undisturbed weather days in all seasons. Three patterns of temperature structure evolution were identified from the data. These patterns led to a hypothesis to account for inversion destruction, in which heat and mass are entrained from the elevated inversion layer into the convective boundary layers (CBLs) and are carried up the sidewalls in the slope flows. Sensible heat flux from the valley surfaces provides the energy to cause the CBLs to grow and provides the energy required to remove mass from the base of the inversion layer in the upslope flows, allowing the inversion layer to sink and warm. Based on this hypothesis a thermodynamic model of inversion breakup was developed. The model is composed of two coupled equations which relate the inversion descent rate and CBL ascent rate to the sensible heat flux.
Dissert. Abstr.

N81-13389# Food and Agriculture Organization of the United Nations, Rome (Italy).
REVIEW OF AGROMETEOROLOGY [APERCU SUR LA METEOROLOGIE AGRICOLE]
Michel Frere *In* ESA Satellite Remote Sensing Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 1-4 In FRENCH (For primary document see N81-13388 04-42)
Avail: NTIS HC A07/MF A01

N81-13394# European Space Operations Center, Darmstadt (West Germany).
THE METEOSAT SYSTEM AND ITS SERVICES [LE SYSTEME METEOSAT ET SES PRODUITS]
M. Fea and P. Louis (European Space Technology Center, Toulouse) *In* ESA Satellite Remote Sensing Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 39-52 In FRENCH (For primary document see N81-13388 04-42)
Avail: NTIS HC A07/MF A01

N81-13396# Direction de la Meteorologie Nationale, Paris (France).
AGROMETEOROLOGICAL METHODS [METHODES AGROMETEOROLOGIQUES]
N. Gerbier and P. Brochet *In* ESA Satellite Remote Sensing Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 65-70 In FRENCH (For primary document see N81-13388 04-42)
Avail: NTIS HC A07/MF A01

N81-13397# World Meteorological Organization, Geneva (Switzerland).
DYNAMIC CLIMATOLOGY [CLIMATOLOGIE DYNAMIQUE]
H. Germain *In* ESA Satellite Remote Sensing Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 71-85 refs In FRENCH (For primary document see N81-13388 04-42)
Avail: NTIS HC A07/MF A01

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N81-13612# National Ocean Survey, Rockville, Md.
TIDE TABLES, 1981. HIGH AND LOW WATER PREDICTIONS. CENTRAL AND WESTERN PACIFIC OCEAN AND INDIAN OCEAN
1980 398 p
(PB80-220932; NOAA-80071504) Avail: NTIS HC A17/MF A01 CSCL 08C

This edition of the Tide Tables, Central and Western Pacific Ocean and Indian Ocean contains full daily predictions for 74 reference stations and differences and other constants for about 1,900 stations. It contains also a table for obtaining the approximate height of the tide at any time, a table of local mean time of sunrise and sunset for every fifth day of the year for different latitudes, a table for the reduction of local mean time to standard time, a table for converting feet to meters, a table of the Greenwich mean time of the Moon's phases, apogee, perigee, greatest north and south and zero declination, and the time of the solar equinoxes and solstices, and a glossary of terms. GRA

N81-13613# National Ocean Survey, Rockville, Md.
TIDE TABLES, 1981. HIGH AND LOW WATER PREDICTION. EUROPE AND WEST COAST OF AFRICA INCLUDING THE MEDITERRANEAN SEA
1980 211 p
(PB80-219850; NOAA-80071503) Avail: NTIS HC A10/MF A01 CSCL 08C

This edition contains full daily predictions for 37 reference

stations and differences and ranges for about 1,000 stations. Tables show (1) how to obtain the approximate height of the tide at any time; (2) local mean time of sunrise and sunset for every fifth day of the year for different latitudes; (3) the reduction of local mean time to standard time; (4) converting feet to meters; (5) the Greenwich mean time of the Moon's phases, apogee, perigee, greatest north and south and zero declination; (6) and the time of the solar equinoxes and solstices. A glossary of terms is included. GRA

N81-13614# National Oceanic and Atmospheric Administration, Seattle, Wash. Pacific Marine Environmental Lab.
OCEAN REMOTE SENSING USING LASER
Howard R. Gordon May 1980 208 p refs Presented at Inst. of Ocean Sci. Symp., Patricia Bay, British Columbia, Canada, 22 Jun. 1978
(PB80-223282; NOAA-TM-ERL-PMEL-18; NOAA-80070710) Avail: NTIS HC A10/MF A01 CSCL 08J

A one-day symposium was organized to bring together investigators actively studying problems associated with the applications and limitations of lasers to the remote sensing of ocean properties. Eight papers are presented. GRA

N81-13615 Oregon State Univ., Corvallis.
TURBULENCE IN THE BOTTOM BOUNDARY LAYER Ph.D. Thesis
Priscilla Anne Newberger 1981 58 p
Avail: Univ. Microfilms Order No. 8028655

The Oregon shell was studied along with two data sets. The first was used to test the hypothesis that the bottom layer is a turbulent boundary layer with the distribution of heat and suspended sediment determined by the turbulent transport of these quantities. Vertical temperature gradient spectra from the second were analysed. The ensemble average of these spectra was compared with the predicted universal form. The inertial range as well as the Batchelor range was observed. A close relationship between active mixing and the structure of the bottom nepheloid layer was shown. Mechanical energy dissipation rates and eddy coefficients were usually consistent with those in unstratified turbulent boundary layer, but an exception was found when stratification due to suspended sediment was required to explain the observations. Except in this case, the suspended particle concentration, for observations in approximately 100 m of water, was consistent with the assumption of local equilibrium between turbulent diffusion and gravitational settling.
Dissert. Abstr.

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N81-13616*# National Aeronautics and Space Administration, Washington, D. C.
ULTRASTRUCTURAL STUDIES OF THE MITOCHONDRIAE IN THE STRIATED MUSCLES OF BIRDS WITH REGARD TO EXPERIMENTAL HYPOKINESIS
M. Belak, J. Kocisova, and K. Boda Jul. 1980 14 p refs Transl. into ENGLISH from Arch. Exp. Veterinaermed. (Leipzig), v. 31, 4 Jul. 1977 p 537-546 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76283) Avail: NTIS HC A02/MF A01 CSCL 06C

Electron microscopic studies were carried out on the mitochrondria of the transversely striated muscles with regard to experimental hypokinesia. As compared to the central group the mitochondria of m. pectoralis thoracicus and the m. iliotibialis posterior in hypokinetic birds reveal marked changes. In filamentous and ovoid mitochondria, vacuoles can be observed which in some cases produced larger light formations with following disappearance of the cristae and destruction of mitochondria. Fat particles located at the poles of the altered mitochondria, sporadically occurring also laterally, presented another finding. The Z-lines of the sarcomere did not form a continuous line, but were somewhat shifted. Author

N81-13617*# National Aeronautics and Space Administration, Washington, D. C.
COMPARATIVE STUDY OF CHOLERETIC AGENTS IN ANESTHETIZED RATS AS WELL AS IN RESTRAINED AND AND UNRESTRAINED RATS, WITH OR WITHOUT COMPENSATION FOR BILIARY LOSS
C. Labrid (Center for Marxist Study and Research, France), G. Dureng (Center for Marxist Study and Research, France), J. Tachon (Center for Marxist Study and Research, France), and P. Duchene-Marullaz Jun. 1980 7 p ref Transl. into ENGLISH from Compt. Rend. Soc. Biol. (Paris), v. 165, no. 4, 1971 p 842-844 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76178) Avail: NTIS HC A02/MF A01 CSCL 06C

Tests were conducted on Wistar rats by using 3 control choleretic agents: 1-phenyl-1-hydroxy n-pentane, dehydrocholic acid, and phenyl-dimethylacetic acid. The effects of these agents were compared in different experimental conditions. The comparative study of choleretic agents in anesthetized rats, in restrained and unrestrained rats, with or without compensation for biliary loss by the biliary secretion of restrained or unrestrained rats does not show, in systematic pharmecodynamic investigations, an obvious superiority over the methods based on the simple technique. Author

N81-13618# Aeronautical Systems Div., Wright-Patterson AFB, Ohio. Deputy for Development Planning.
ACQUISITION STRATEGY IMPLICATIONS OF A LONG RANGE COMBAT AIRCRAFT (LRCA) Final Report, Feb. - Jun. 1980
Jerome P. Sutton Jul. 1980 84 p
(AD-A091109; ASD/XRM-TR-80-5044) Avail: NTIS HC A05/MF A01 CSCL 01/3

This report contains a discussion of the acquisition implications of the Long Range Combat Aircraft (LRCA) to include: affordability, availability, logistics, and SALT II aspects. Assessment of the LRCA concept involved consideration of two alternative program schedules, Milestone II 1981, and Milestone II - 1985, and thus, consideration of a near term and mid-term technology level. Since the LRCA is in a pre-Milestone 0 status, no firm conclusions regarding an ultimate program can be reached; results of this assessment would support some preliminary implications. For the LRCA to be affordable requires that substantive reprogramming of the budget be undertaken. More importantly, the priority of the program must be sustained throughout the acquisition cycle. The availability of resources to support the LRCA requires planning and management and does not present insurmountable difficulties. The initial operational capability (IOC) may, depending on the exigency of the need, not be when one may wish it. Full capability is most likely not possible prior to the mid-1990s. The final design of the LRCA and its weapons complement are dependent upon consideration of the Strategic Arms Limitation Treaty (SALT II) as ratified. GRA

N81-13619# Sandia Labs., Albuquerque, N. Mex.
EFFECTIVENESS OF IRRADIATION IN KILLING PATHOGENS
J. Gary Yeager (BDM Corp., Albuquerque, N. Mex.) and Richard L. Ward 1980 29 p refs Presented at the Natl. Symp. on the User of Cesium-137 to Process Sludge for Further Reduction of Pathogens, Denver, 3 Sep. 1980
(Contracts DE-AC04-76DP-00789; E(29-2)-3536; EPA-IAG-D6-0675)
(SAND-80-7124C; CONF-800964-2) Avail: NTIS HC A03/MF A01

United States Environmental Protection Agency regulations include gamma ray irradiation of sludge as an approved process to further reduce pathogens (PFRP) prior to land application. It is shown that the 1 Mrad PFRP dose is capable, by itself, of eliminating bacterial, fungal, and parasitic pathogens from sludge. Gamma irradiation of sludge in conjunction with the required processes to significantly reduce pathogens should also eliminate the viral hazard from wastewater sludges. DOE

N81-13620# National Academy of Sciences - National Research Council, Washington, D. C. Inst. of Lab. Animal Resources.

ANIMAL FACILITIES AND RESOURCES SUPPORTING BIOMEDICAL RESEARCH IN THE UNITED STATES IN FISCAL YEAR 1978 Final Report
Mar. 1980 84 p refs
(Contract N01-RR-7-2114; NIH Proj. DRR-77-5)
(PB80-210636; NIH/DRR-77-5) Avail: NTIS HC A05/MF A01 CSCL 06C

Survey questionnaries were distributed to 2,637 known users of laboratory animals in the United States, and 1,902 (72%) were returned. Of these, the responses of 1,252 organizations fulfilled the Committee's criteria for inclusion in the response, population for aggregate analysis. The report is divided into six sections: dimensions of survey population, animal use and sources, facility administration and personnel, facilities and equipment, costs of animal care, and appendix. GRA

N81-13621 Illinois Univ. at Urbana-Champaign.
SYNTHESIS, CHARACTERIZATION AND REACTIVITY OF ELECTRON RICH TRANSITION METAL ORGANOMETALLIC COMPLEXES Ph.D. Thesis
James Joseph Welter 1980 97 p
Avail: Univ. Microfilms Order No. 8026618

A study of the reaction of bis(cyclopentaldeinyl) tantalum trihydride with n-butyllithium in the presence of 1,1,4,77-pentamethyldiethylenetriamine is presented. It was found from a deuteration study of the amine chelated tantalum-lithium reagent that the metalation indeed occurs at the tantalum atom by abstraction of a hydrogen atom. This metalation was not specific to either of the two sets of non-equivalent hydride positions of the tantalum hydride. The amine chelated tantalum lithium reagent was also reacted with ethyl bromide to yield an apparently alkylated product. Dissert. Abstr.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N81-13622* National Aeronautics and Space Administration, Washington, D. C.
NASA TO STUDY EFFECTS OF JET LAG ON PILOT PERFORMANCE
24 Dec. 1980 4 p
(NASA-News-Release-80-197; P80-10204) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 06P

Existing scientific literature on circadian rhythm was translated into lay terms and disseminated to the aviation community. The effects of rest, sleep, dietary, and drug use patterns of commercial airline crews were investigated. T.M.

N81-13623 Indiana Univ., Bloomington.
THE PHYSIOLOGICAL AND BIOMECHANICAL EFFECTS OF ISOTONIC AND ISOKINETIC STRENGTH TRAINING PROGRAMS ON COLLEGIATE SOCCER PLAYERS Ph.D. Thesis
Helmi Hussen Mahmoud 1980 279 p
Avail: Univ. Microfilms Order No. 8020033

The changes which take place in the body composition, anthropometric measurements, cardiovascular endurance, power, muscular endurance, muscular strength, and soccer neuromuscular skills of male soccer players were studied. Twenty five soccer players were randomly assigned to either isotenic or isokinetic strength training programs. Their performance was recorded on two separate testing sessions, one before and the other after the 12 weeks strength training program. The training program included ten different strength exercises, practiced for three sets each with (6 RM) for isotonic, and (10 RM) for isokinetic group three days a week for 12 weeks. The Statistical Package for Social Science was used in the descriptive and inferrential statistical analysis to test the significant changes between the two groups at alpha = 0.05. Dissert. Abstr.

N81-13624 Georgia Univ., Athens.
EFFECT OF ACTIVE AND PASSIVE RECOVERY ON SUBSEQUENT TREADMILL RUNNING PERFORMANCE Ph.D. Thesis
Ung Dae Kong 1980 99 p
Avail: Univ. Microfilms Order No. 8029134

Physical characteristics were measured and a treadmill stress test was administered to assess the maximal oxygen uptake and selected other measures of metabolic and cardiorespiratory capacity. Physiological measurements obtained during the stress test included maximal ventilation, oxygen uptake, respiratory exchange ratio, heart rate and blood lactic acid concentration. All subjects completed two all-out treadmill runs to exhaustion at a speed estimated to elicit 110 percent of the subject's maximal oxygen uptake under two conditions: with 20 minutes of active recovery between runs and with 20 minutes of passive recovery between runs. Treadmill run performance following active recovery is significantly better than that following passive recovery. The better subsequent performance following active recovery appears related to lower post recovery levels of blood lactic acid. Dissert. Abstr.

N81-13625 Purdue Univ., Lafayette, Ind.
AN EXPERIMENTAL AND THEORETICAL INVESTIGATION OF THE OSCILLOMETRIC METHOD OF INDIRECT BLOOD PRESSURE MEASUREMENT Ph.D. Thesis
Gregory William Mauck 1980 281 p
Avail: Univ. Microfilms Order No. 8027302

Employing several simplifying assumptions the complex system of blood pressure cuff, arm tissues and artery is reduced to a simplified experimental model consisting of a collapsible elastic vessel enclosed within a rigid compression chamber filled with liquid and air. A one dimensional theoretical model based upon the experimental model is also derived. Employing the experimental and theoretical models, the effects of system parameters are examined. The accuracy of the oscillometric method in predicting direct mean arterial pressure for the model was found to be most dependent upon the ratio of compression chamber air volume to unstressed arterial volume with a decrease in accuracy as the volume ratio increases. The existance of an optimal value for the ratio of compression chamber air volume to unstressed arterial volume is both suggested experimentally and shown to exist theoretically. The effects of arterial distensibility on the oscillometric method were examined using the theoretical model and shown to have a minimal effect on the prediction of mean arterial pressure. Dissert. Abstr.

N81-13626*# National Aeronautics and Space Administration, Washington, D. C.
DECLINING INTERSTITIAL TRANSSUDATION IN MAN
P. deMarchin (Liege Univ., Belgium), D. Lagneaux (Liege Univ., Belgium), and J. Lecomte (Liege Univ., Belgium) Sep. 1980 8 p refs Transl. into ENGLISH from Compt. Rend. Soc. Biol. (Paris), v. 173, no. 1, 1979 p 165-168
(Contract NASw-3199)
(NASA-TM-75858) Avail: NTIS HC A02/MF A01 CSCL 06P

Results and methodology of experimentation dealing with declining interstitial transsudation are discussed. Concepts of the formation of interstitial fluids are in agreement with measurements of calf volume in normal young women, in horizontal recumbency or after horizontal immersion. The volume of the calf is reduced when the hydrostatic pressure of the blood column is diminished under the phlebostatic level and when the external pressure is increased by the hydrostatic pressure of a water bath. M.G.

N81-13627*# National Aeronautics and Space Administration, Washington, D. C.
CYCLIC AMP SYSTEM IN MUSCLE TISSUE DURING PROLONGED HYPOKINESIA
Ye. A. Antipenko, Yu. A. Bubeyev, B. F. Korovkin, and N. P. Mikhaleva Jun. 1980 7 p refs Transl. into ENGLISH from Vop. Med. Khim. (USSR), v. 24, no. 6, 1978 p 765-768 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Kirov Military Medical Academy, Leningrad
(Contract NASw-3199)
(NASA-TM-76186) Avail: NTIS HC A02/MF A01 CSCL 06S

Components of the cyclic Adenosine-cyclic-35-monophosphate (AMP) system in the muscle tissue of white rats were studied during 70-75 days of hypokinesia, created by

placing the animals in small booths which restricted their movements, and during the readaptation period. In the initial period, cyclic AMP levels and the activities of phosphodiesterase and adenylate cyclase in muscle tissue were increased. The values for these indices were roughly equal for controls and experimental animals during the adaptation period, but on the 70th day of the experiment cAMP levels dropped, phosphodiesterase activity increased, and the stimulative effect of epinephrine on the activity of adenylate cyclase decreased. The indices under study normalized during the readaptation period. Author

N81-13628*# National Aeronautics and Space Administration, Washington, D. C.
ROLE OF THE MIDDLE EAR MUSCLE APPARATUS IN MECHANISMS OF SPEECH SIGNAL DISCRIMINATION
B. S. Moroz, V. G. Bazarov, and S. V. Sachenko Oct. 1980 10 p refs Transl. into ENGLISH from Zh. Ushnykh. Nosovykh Gorlovkh Bolez (USSR), no. 5, Sep. - Oct. 1979 p 24-28 Translated by Kanner (Leo) Associates, Redwood City, Calif.
(NASA-TM-76408) Avail: NTIS HC A02/MF A01 CSCL 06P

A method of impedance reflexometry was used to examine 101 students with hearing impairment in order to clarify the interrelation between speech discrimination and the state of the middle ear muscles. Ability to discriminate speech signals depends to some extent on the functional state of intraaural muscles. Speech discrimination was greatly impaired in the absence of stapedial muscle acoustic reflex, in the presence of low thresholds of stimulation and in very small values of reflex amplitude increase. Discrimination was not impeded in positive AR, high values of relative thresholds and normal increase of reflex amplitude in response to speech signals with augmenting intensity. Author

N81-13629# Connecticut Univ., Farmington. School of Medicine.
TOXICOLOGY AND METABOLISM OF NICKEL COMPOUNDS Progress Report, 1 Dec. 1979 - 30 Nov. 1980
F. William Sunderman, Jr. 15 Aug. 1980 15 p refs
(Contract DE-AS02-76EV-03140)
(DOE/EV-03140/5) Avail: NTIS HC A02/MF A01

Documentation that nickel carbonyl is teratogenic and embryotoxic in hamsters is presented. A new experimental model for chemical induction of ocular neoplasms in rats by intraocular injection of alpha Ni3S2 was developed. A reference method for analysis of nickel in serum and urine by electrothermal atomic absorption spectrophotometry was developed in order to monitor occupational and environmental exposures to nickel compounds. T.M.

N81-13630# California Univ., Davis. Lab. for Energy-Related Health Research.
DEPOSITION AND CLEARANCE OF INHALED AEROSOLS
Otto G. Raabe 1979 63 p refs
(Contracts DE-AC03-76SF-00472; EY-76-C-03-0472)
(UCD-472-503) Avail: NTIS HC A04/MF A01

The particle size distribution and chemical and physical composition of airborne particulate material require special attention in evaluation of respiratory toxicology since a wide variability of physico-chemical properties may be encountered in both experimental and actual inhalation exposures. The essential features of the main factors affecting the mechanism of aerosol deposition and clearance are summarized. Selected references to available published works were chosen to illustrate these factors rather than to serve as a complete bibliography. Although some supportive data from studies with experimental animals were cited to illustrate basic phenomena, the emphasis is on deposition and clearance of potentially toxic particulate materials inhaled by people. DOE

N81-13631# Sandia Labs., Albuquerque, N. Mex. Fuel Cycle Risk Analysis Div.
RADIATION PROTECTION: AN ANALYSIS OF THYROID BLOCKING
David C. Aldrich and Roger M. Blond 1980 15 p refs Presented at the Intern. Conf. on Current Nucl. Power Plant Safety Issues, Stockholm, 20-24 Oct. 1980 Prepared in cooperation with the Nuclear Regulatory Commission, Washington, D.C.
(SAND-80-2148C; CONF-801056-5; IAEA-CN-39/102) Avail: NTIS HC A02/MF A01

An analysis was performed to provide guidance to policy makers concerning the effectiveness of potassium iodide (KI) as a thyroid blocking agent in potential reactor accident situations, the distance to which (or area within which) it should be distributed, and its relative effectiveness compared to other available protective measures. The analysis was performed using the Reactor Safety Study (WASH-1400) consequence model. Four categories of accidents were addressed: gap activity release accident (GAP), GAP without containment isolation, core melt with a melt through release, and core melt with an atmospheric release. Cost benefit ratios (US $/thyroid nodule prevented) are given that no other protective measures are taken. Uncertainties due to health effects parameters, accident probabilities and costs are assessed. The effects of other potential protective measures, such as evacuation and sheltering, and the impact on children (critical population) are evaluated. Finally, risk benefit considerations are briefly discussed. Author

N81-13632# California Univ., San Diego, La Jolla. Dept. of Medicine.
RESPIRATORY FUNCTION AT EXTREME ALTITUDES Final Report, 1 Apr. 1976 - 31 Mar. 1980
John B. West Aug. 1980 9 p refs
(Contract N01-HR-6-2915)
(PB80-213010; NIH-N01-HR-6-2915-F) Avail: NTIS HC A02/MF A01 CSCL 06S

Considerable progress was made in defining the experimental techniques for obtaining data under extremely arduous conditions. Design of some of the equipment was completed. A plan was formulated of mounting a primarily scientific expedition to Mt. Everest. GRA

N81-13633# National Telecommunications and Information Administration, Washington, D.C.
NONIONIZING ELECTROMAGNETIC RADIATION SAFETY: A PROGRAM OF COORDINATED FEDERAL ACTIVITIES RELATED TO BIOLOGICAL EFFECTS OF NONIONIZING ELECTROMAGNETIC RADIATION (0-300 GHz)
Dec. 1979 90 p
(PB80-211212; NTIA-SP-80-7) Avail: NTIS HC A05/MF A01 CSCL 06R

A program for coordinated Federal activities on nonionizing electromagnetic radiation safety is described. The program seeks to develop a better understanding of biological effects and interactions of NER through identification of several program objectives: determine population exposure (environmental, occupational, consumer and medical); determine energy absorbed; determine biological consequences of exposure; develop instrumentation and exposure systems; conduct assessments of risk and impact; and recommend control measures. GRA

N81-13634 California Univ., Davis.
STUDIES ON THE EFFECTS OF RADIATION ON HUMAN LYMPHOCYTES
Susan Jane Knox 1980 163 p
Avail: Univ. Microfilms Order No. 8027064

Hematopotetic progenitor populations were found to be sensitive biodosimeters of hermatopoietic radiation injury using in virto cloning of lymphocytes and the lymphocyte simulation test (LST). A technique was developed for the selective growth of human T lymphocyte colonies from whole blood in a single phase semisolid culture system following stimulation with phytohemagglutinin-P (PHA-P), Concanavalin-A (Con-A), or purified protein derivative of Mycobacterium tuberculosis (PPD). Radiation dose response effects were studied using both whole blood and density gradient separated mononuclear cells in the LST and colony formation assay with PHA-P, Con-A, pokeweed mitogen protein a form Staphylococcus aureus, PPD and allogeneic mixed lymphocyte stimulation. Generally, assays using whole blood in place of gradient separated cells were capable of detecting radiation effects at lower dose levels. Dissert. Abstr.

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

No abstracts in this category.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N81-13635*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HEAD-UP TRANSITION BEHAVIOR OF PILOTS WITH AND WITHOUT HEAD-UP DISPLAY IN SIMULATED LOW-VISIBILITY APPROACHES
Richard F. Haines, Edith Fischer, and Toni A. Price Dec. 1980 37 p refs Prepared in cooperation with San Jose Univ. Foundation, Calif.
(NASA-TP-1720; A-8296; HUD-10) Avail: NTIS HC A03/MF A01 CSCL 05H

To quantify head-up transition behavior with and without a flightpath type head-up display, eight rated B-727 pilots each flew 31 manual and coupled approaches in a simulator with B-727 dynamics and collimated model board external scene. Data were also obtained on the roll played by the head-up display in the coupled-to-manual transition. Various wind shears, low visibilities, and ceilings were tested along with unexpected misalignment between the runway and head-up display symbology. The symbolic format used was a conformal scene. Every pilot except one stayed head-up, flying with the display after descending below the ceiling. Without the display and as altitude decreased, the number of lookups from the instrument panel decreased and the duration of each one increased. No large differences in mean number or duration of transitions up or down were found during the head-up display runs comparing the no-misalignment with the lateral instrument landing system offset misalignment runs. The head-up display led to fewer transitions after the pilot made a decision to land or execute a missed approach. Without the display, pilots generally waited until they had descended below the ceiling to look outside the first time, but with it several pilots looked down at their panel at relatively high altitudes (if they looked down at all). Manual takeover of control was rapid and smooth both with and without the display which permitted smoother engine power changes.
E.D.K.

N81-13636*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COGNITIVE ISSUES IN HEAD-UP DISPLAYS
Edith Fischer and Richard F. Haines (San Jose State Univ., Calif.) Dec. 1980 32 p refs
(NASA-TP-1711; A-8246) Avail: NTIS HC A03/MF A01 CSCL 01D

The ability of pilots to recognize and act upon unexpected information, presented in either the outside world or in a head-up display (HUD), was evaluated. Eight commercial airline pilots flew 18 approaches with a flightpath-type HUD and 13 approaches with conventional instruments in a fixed-base 727 simulator. The approaches were flown under conditions of low visibility, turbulence, and wind shear. Vertical and lateral flight performance was measured for five cognitive variables: an unexpected obstacle on runway; vertical and lateral boresight-type offset of the HUD; lateral ILS beam bend-type offset; and no anomaly. Mean response time to the runway obstacle was longer with HUD than without it (4.13 vs 1.75 sec.), and two of the pilots did not see the obstacle at all with the HUD. None of the offsets caused any deterioration in lateral flight performance, but all caused some change in vertical tracking; all offsets seemed to magnify the environmental effects. In all conditions, both vertical and lateral tracking was better with the HUD than with the conventional instruments.
Author

N81-13637# Man Factors, Inc., San Diego, Calif.
HUMAN ENGINEERING DESIGN CRITERIA FOR MODERN CONTROL/DISPLAY COMPONENTS AND STANDARD PARTS Final Report, 16 May 1979 - 16 May 1980
W. E. Woodson and C. Coburn May 1980 43 p refs
(Contract DAAK40-79-C-0145)
(AD-A091191; AD-E950044; MFI-80-101-R; DRSMI/RS-CR-80-2) Avail: NTIS HC A03/MF A01 CSCL 05/5

Review and analysis of control-display requirements in MIL-STD-1472B for the purpose of updating to reflect contemporary hardware component use in military system, equipment and component products. In addition to detailed modifications, general recommendations are made for future standard revision.
GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering*.

N81-13638 Illinois Univ. at Urbana-Champaign.
OPTIMIZATION AND INTERCONNECTION COMPLEXITY FOR: PARALLEL PROCESSORS, SINGLE STAGE NETWORKS, AND DECISION TREES Ph.D. Thesis
Robert Henry Kuhn 1980 263 p
Avail: Univ. Microfilms Order No. 8026541

Three problems involving the use of parallel processors are discussed. The first problem considered is to develop tools to aid an optimizing compiler to analyze the array or vector data flow in source programs. The solution proposed is to represent the array reference and the loop iteration sets as convex sets. Algorithms are developed for manipulating convex sets with these theoretic operations currently used by scalar data flow analysis. The second problem considered is to optimize the interconnection complexity of algorithms being mapped to limited interconnection networks such as the mesh or the shuffle. Two transformations are developed which are shown to work well when algorithms are mapped to single stage interconnections between processors, and when algorithms are implemented in VLSI with single stage, low chip area, interconnections. The third problem considers transformations that can be used to speed up the control flow in algorithms which heav been considered to be inherently sequential. It is shown that transformations which speed up arithmetic expression evaluation commutativity and distribution, can be used to speed up decision tree evaluation. Dissert. Abstr.

N81-13639 *California Univ., Santa Barbara.*
A PARALLEL PIPELINE COMPUTER ARCHITECTURE FOR SPEECH PROCESSING Ph.D. Thesis
Vassilios John Georgiou 1980 213 p
Avail: Univ. Microfilms Order No. 8027770

A modular multicomputer architecture for digital speech (and signal) processing is discussed that is eminently suitable for implementation using very large scale integration techniques. Processors built using this approach consist of several hardware identical computers (called Array Block Computers or ABC's) interconnected to form a number of functional block pipelines operating in parallel. Data transfers between ABC's occur simultaneously for all ABC's. All data exchange are controlled totally by hardware and they are transparent to the programmer. The interconnecting topology for the ABC's is identical to the block diagram of the function performed. Performance increases linearly with the number of the ABC's. A prototype was built using the AMD 2901-4 bit slice microprocessor. Sufficient performance was obtained for complex real time speech processing at a cost comparable to commercially available signal processors. It is estimated that it will be possible to interface a whole ABC with performance superior to the current implementation on a silicon chip using 1 micron NMOS technology. A serial communication scheme is proposed that would allow such ABC's to be packaged in an 8-pin package. Dissert. Abstr.

N81-13640# Massachusetts Inst. of Tech., Cambridge. Center for Information Systems Research.
A SYSTEMATIC APPROACH TO COMPLEX SYSTEM DESIGN: AN APPLICATION TO PRINTED CIRCUIT BOARD TEST SYSTEM DESIGN
Pei-Ti Tung May 1980 197 p refs
(Contract N00039-80-K-0573; Grant N00039-78-G-0160)
(AD-A090707; CISR-P010-80002-13; CSIR-TR-13) Avail: NTIS HC A09/MF A01 CSCL 09/2

The Systematic Design Methodology (SDM) is a set of concepts and techniques currently under development at MIT Center for Information Systems Research (CISR). The SDM is oriented toward assisting software designers (or design teams) in the task of structuring the architecture, the preliminary design for a complex system. Essential to the methodology development is the testing of the methodology. The most promising but also the most challenging testing alternative is to test the methodology against real world design problems. This thesis involves testing the methodology in a real world context where real system designers participate in applying the methodology to their design problem at hand. The application system is the test program preparation software of printed-circuit-board functional test system currently under development. Included in this report is a description of the process by which SDM was applied and an analysis of the results obtained. Insights and experiences gained in the use of the methodology are discussed throughout. GRA

N81-13641# Rome Air Development Center, Griffiss AFB, N.Y.
THE SPECIFICATION OF A DATA BASE MACHINE ARCHITECTURE DEVELOPMENT FACILITY AND METHODOLOGY FOR DEVELOPING SPECIAL PURPOSE FUNCTION ARCHITECTURES
Raymond A. Liuzzi Jul. 1980 288 p *refs*
(AD-A090826; RADC-TR-80-256) Avail: NTIS HC A13/MF A01 CSCL 09/2

This research is concerned with specifying the set of components/tools needed in a Data Base Architecture Development (DMAD) Facility. A methodology is described to illustrate how this proposed facility can be used to develop special purpose function architectures (SPFAs). These SPFAs perform a data base management function in hardware that is currently performed in software on a sequential computer. This methodology includes a series of processes which are the select candidate function process and the create, test, evaluate, and substitute SPFA processes. Each process can be performed with a series of procedures that utilize tools/components of the DMAD facility. The select candidate function process would use the facility to help choose candidate DBMS functions to be moved from software to hardware. For this process, assume that a data base management system (DBMS) executes on an emulated computer system in the facility. Software modules that comprise the DBMS and provide the DMBS functions would be studied as logical candidates to be moved into hardware. When a candidate is chosen one or more SPFAs may be chosen as replacements. This choice is made by developing these SPFAs as machines, using the facility and comparing their performance for a specific application. GRA

N81-13642# Air Force Weapons Lab., Kirtland AFB, N. Mex.
A SOLUTION TO THE LARGE CODE PROBLEM ON THE AFWL SCIENTIFIC COMPUTERS Final Report
Robert W. Berry Sep. 1980 27 p refs
(AF Proj. 2444)
(AD-A091244; AD-E200584; AFWL-TR-80-20) Avail: NTIS HC A03/MF A01 CSCL 09/2

This report addresses the issue of executing large and long running codes on the Air Force Weapons Laboratory large-scale scientific computers, and the problem of obtaining results in a reasonable amount of time with minimum cost. Impact on other users is discussed as well as inefficiencies resulting from the diverse job mix on the large machines. The ALFA code is used to present cost information relating to the current mode of operation. An alternative to this mode of operation is offered. A 32-bit minicomputer system which uses a virtual memory addressing scheme and incorporates fast, large capacity disk storage, suitable 1/O equipment, sufficient high speed main memory, and a powerful attached array processor is recommended. This system would be used in dedicated mode by one user at a time. The cost advantages of this approach are presented, and continuing actions on this project are recommended. GRA

N81-13643# Stanford Univ., Calif. Dept. of Computer Science.
ON THE DESIGN, USE, AND INTEGRATION OF DATA MODELS Ph.D. Thesis
Ramez-Aziz El-Masri May 1980 121 p
(Contract MDA903-76-C-0206)
(AD-A091384; SU-STAN-CS-80-801) Avail: NTIS HC A06/MF A01 CSCL 09/2

An approach to logical data base design is described wherein each prospective group of users, along with data base design experts, are responsible for defining their own processing and data requirements as a data model. These data models are then integrated to form a global data base model. Semantic concepts for modelling are categorized and a 'structural model' is introduced as the formal design tool. The structural model implicitly represents the constraints of a situation, as well as the methods to maintain these constraints when the underlying data base is updated. Two possible languages for use in the data base system are discussed. Modelling and model integration procedures are demonstrated. M.G.

N81-13644# Mission Research Corp., La Jolla, Calif.
RAM TECHNOLOGY STUDY Topical Report, 1 Feb. - 31 Dec. 1979
James P. Raymond 3 Jan. 1980 59 p *refs*
(Contract DNA001-79-C-0137)
(AD-A091372; MRC/SD-R-52; DNA-5163-T) Avail: NTIS HC A04/MF A01 CSCL 09/5

Electrical performance and radiation hardness parameters of modern RAM technologies were compared for consideration in military hardened system applications. Semiconductor technologies considered included production dynamic n-MOS, static n-MOS, CMOS, bipolar ECL developing CMOS/SOS and bipolar I2L. For the production technologies CMOS and bipolar ECL are clear candidates for hardened systems with limited application for static n-MOS and very limited application for dynamic n-MOS. GRA

N81-13645# Hawaii Univ., Honolulu. Dept. of Electrical Engineering.
COMPUTER ORGANIZATION AND INFORMATION HIDING Interim Report
Rahul Chattergy 15 Jul. 1980 18 p *refs*
(Contract DASG60-79-C-0118)
(AD-A091242; IR-3) Avail: NTIS HC A02/MF A01 CSCL 09/2

A new internal organization of a computer is proposed by applying the principle of information hiding to the structure of a computer. The new organization is inspected in the light of the

requirements set forth on computer organization by Functional Programming systems. The current status of the implementation of such a computer and the future directions of research are mentioned. GRA

N81-13646# *Massachusetts Inst. of Tech., Cambridge. Computer Science Lab.*

A SEMANTICS OF SYNCHRONIZATION M.S. Thesis - Aug. 1980

Carl R. Seaquist Sep. 1980 115 p refs

(Contract N00014-75-C-0661; NSF MCS-78-17698)

(AD-A091015; MIT/LCS/TM-176) Avail: Issuing Activity CSCL 09/2

This paper presents a rigorous framework to discuss the synchronization necessary to coordinate accesses to a resource. The framework, among other things, provides a method for specifying concurrency and forms the semantic basis of a synchronization mechanism which avoids certain unfortunate characteristics of monitors and serializers. Synchronization is viewed as being managed by a resource guardian. A synchronization problem is defined as a predicate on event sequences. The interaction of a guardian and the rest of the system is formalized in terms of a two person game. This formalization results in precise definitions of guardian and guardian behavior. The notion of a 'good' or optimal solution is defined, and the solutions to certain classes of synchronization problems are characterized. An abstract description of the general actions of a guardian is given. This general description, with some restrictions, forms the basis of a simple synchronization mechanism for actually implementing solutions. The mechanism is given a rigorous semantics based on the definition of guardian. This facilitates the verification of correctness. Many examples of the use of the mechanism are given and its advantages are discussed. GRA

N81-13228*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

THE MICROPROCESSOR-BASED SYNTHESIZER CONTROLLER

M. R. Wick *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 152-154 refs (For primary document see N81-13210 04-31)

Avail: NTIS HC A09/MF A01 CSCL 09B

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N81-13647# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.

FORTRAN SUBROUTINES FOR THE NUMERICAL SOLUTION OF OPTIMAL CONTROL PROBLEMS

Dieter Kraft Feb. 1980 110 p refs In GERMAN; ENGLISH summary

(DFVLR-MITT-80-03) Avail: NTIS HC A06/MF A01

FORTRAN subroutines for the numerical solution of optimal control problems based on parametric control models are described. A user's guide is given by an example. The complete program listings are appended together with the example output. Author

N81-13648# Massachusetts Inst. of Tech., Cambridge. Center for Information Systems Research.

A GRAPH DECOMPOSITION TECHNIQUE BASED ON A HIGH-DENSITY CLUSTERING MODEL ON GRAPHS

M. Anthony Wong Jul. 1980 40 p refs

(Contract N00039-80-K-0573)

(AD-A090348; CISR-P010-8007-14; CISR-TR-14) Avail: NTIS HC A03/MF A01 CSCL 12/2

Complex design problems are characterized by a multitude of competing requirements. System designers frequently find the scope of the problem beyond their conceptual abilities, and attempt to cope with this difficulty by decomposing the original design problem into smaller, more manageable sub-problems. Functional requirements form a key interface between the users of a system and its designers. In this research effort, a systematic approach has been proposed for the decomposition of the overall set of functional requirements into sub-problems to form a design structure that will exhibit the key characteristics of good design: strong coupling within sub-problems, and weak coupling between them. A scan of the graph decomposition algorithms review that none of the existing techniques is particularly well suited for use in Systematic Design Methodology. In this report, a clustering model on a graph is defined, using the concept of natural or high density clusters which are densely-connected subgraphs separated by relatively few links. A graph decomposition technique based on this high-density clustering model is developed for identifying the best natural partition for a given graph. GRA

N81-13649# *Naval Postgraduate School, Monterey, Calif.*

NPS MICRO-COBOL: AN IMPLEMENTATION OF A SUBSET OF ANSI-COBOL FOR A MICROCOMPUTER SYSTEM *M.S. Thesis*

Hal R. Powell Jun. 1980 337 p refs

(AD-A091060) Avail: NTIS HC A15/MF A01 CSCL 09/2

A compiler for a subset of the Automated Data Processing Equipment Selection Office (ADPESO), HYPO-COBOL, has been implemented on a microcomputer. The implementation provides nucleus level constructs, interprogram communications, and file options from the ANSI COBOL package along with the PERFORM UNTIL, PERFORM VARYING and an enhanced version of the IF-THEN-ELSE construct that includes nesting and multiple program statements for both the 'THEN' and 'ELSE' clauses. These additional constructs from level two of ANSI-COBOL provide for more flexibility and increased structural control. The language was implemented through a compiler and run-time package executing under the CP/M operating system of a Z-80 or an 8080 microcomputer-based system. Both the compiler and interpreter can be executed in 20K bytes of main memory. A program consisting of 5K bytes of symbol table entries can be supported on this size machine. Modification of the compiler and interpreter programs can be accomplished to take advantage of larger machines. The programs that make up the compiler and interpreter package require 50K bytes of disk storage. GRA

N81-13650# Stanford Univ., Calif. Dept. of Computer Science.

EXPRESSION PROCEDURES AND PROGRAM DERIVATION Ph.D. Thesis

William Louis Scherlis Aug. 1980 99 p

(Contract N00014-76-C-0687)

(AD-A091187; SU-STAN-CS-80-818) Avail: NTIS HC A05/MF A01 CSCL 12/1

We explore techniques for systematically deriving programs from specifications. The goal of this exploration is a better understanding of the development of algorithms. Thus, the intention is not to develop a theory of programs, concerned with the analysis of existing programs, but instead to develop a theory of programming, dealing with the process of constructing new programs. Such a theory would have practical benefits both for programming methodology and for automatic program synthesis. We investigate the derivation of programs by program transformation techniques. By expanding an ordinary language of recursion equations to include a generalized procedure construct (the expression procedure), our ability to manipulate programs in that language is greatly facilitated. The expression procedure provides a means of expressing information not just about the properties of individual program elements, but also about the way they relate to each other. In this extended language, a set of three operations - abstraction, application, and composition for transforming programs is presented. We prove that these operations preserve the strong equivalence of programs by using operational semantics. The well-known systems of Burstall and Darlington and of Manna and Waldinger are both based on an underlying rule system that does not have this property. GRA

N81-13651# *General Research Corp., Santa Barbara, Calif.*

JOVIAL J73 AUTOMATED VERIFICATION SYSTEM: STUDY PHASE Final Technical Report, Sep. 1979 - Apr. 1980

Carolyn Gannon Griffiss AFB, N.Y. RADC Aug. 1980 97 p refs

(Contract F30602-79-C-0265; AF Proj. 2532)
(AD-A091190; RADC-TR-80-261) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report presents the results of a study to specify the required capabilities and high-level design of an automated tool to support the testing and verification of JOVIAL J73 software systems. Included is a state-of-the-art review of software testing and verification with emphasis on techniques applicable to JOVIAL J73 programs. GRA

N81-13652# Center for Naval Analyses, Alexandria, Va. Operations Evaluation Group.

EVALUATION OF COMPUTER SOFTWARE IN AN OPERATIONAL ENVIRONMENT

Gregory H. Watson Aug. 1980 23 p Presented at the Joint Natl. Meeting of The Inst. for Management Sci. (TIMS) and the Operations Res. Soc. of Am. (ORSA), Washington, D. C., 5 May 1980
(AD-A091213; OEG-PP-290) Avail: NTIS HC A02/MF A01 CSCL 09/2

This paper examines general procedures for testing military realtime operational software from the user's perspective. A summary of industrial software testing is given with an evaluation of its applicability to the military's requirement for operational testing. The operational test environment is examined to determine the extent of verification, validation or certification of computer software that is possible given the constraints of this environment. GRA

N81-13653# McDonnell-Douglas Corp., Huntington Beach, Calif.

METRICS OF SOFTWARE QUALITY Final Annual Report, 1 Jun. 1979 - 31 May 1980

Z. Jelinski and P. B. Moranda Aug. 1980 53 p refs
(Contract F49620-77-C-0099; AF Proj. 2304)
(AD-A091385; AFOSR-80-1010TR) Avail: NTIS HC A04/MF A01 CSCL 09/2

The software required to test FORTRAN programs, first with random numbers and then by preselected constructed cases, was developed during this interval. Software modifications were made to permit performance measurements of the degree of coverage to include the results due to the use of constructed cases. The automation of the mix of random numbers and constructed cases was studied and limitations were found. Two new models for use during the development phase of programming were developed. These models apply to programs which grow in size during the debugging period. GRA

N81-13654# New York Univ., N. Y. Inst. of Mathematical Sciences.

INTERNAL, EXTERNAL, AND PRAGMATIC INFLUENCES: TECHNICAL PERSPECTIVES IN THE DEVELOPMENT OF PROGRAMMING LANGUAGES

Jacob T. Schwartz Jul. 1980 77 p refs
(Contract N00014-78-C-0639)
(AD-A091301; TS-020) Avail: NTIS HC A05/MF A01 CSCL 09/2

This paper reviews key issues likely to shape the design and development of programs and programming languages as efficiency constraints relax and computational power increases. These issues are; (1) the use of the dictions of mathematics to define operations that can be used to achieve user-defined desires and expectations concerning an intended application; (2) techniques for designing and producing the expected results: the use of very-high-level programming languages for prototyping; the development of application-oriented languages; the design of applications using standard operations; and the development of a library of modules which handle substantial fragments of important applications; and (3) a language's usefulness, i.e., its general nature and its user-oriented features. GRA

N81-13655# Army War Coll., Carlisle Barracks, Pa.

SOFTWARE MANAGEMENT

Philip S. Threefoot 28 May 1980 32 p refs
(AD-A091253) Avail: NTIS HC A03/MF A01 CSCL 09/2

The purpose of the paper is to outline practical management techniques tailored to the uniqueness of software development. The central theme is visibility into the software development and the ways to achieve it. The areas of documentation, testing, personnel, configuration management, and incentives are examined. The techniques described were developed while managing the software for the Tactical Fire Direction System, a software intensive, command and control system containing approximately one million lines of source code. GRA

N81-13656# Carnegie-Mellon Univ., Pittsburgh, Pa. Mellon Inst. of Science.

DDP DEVELOPMENT FACILITY CAPABILITIES FOR EFFECTIVE ACQUISITION OF DDP SOFTWARE AND HARDWARE

L. L. Cheng, M. A. Kowalski, D. V. Klein, M. L. Soffa, W. T. Sze, and P. Vansickle Jun. 1980 210 p refs
(Contract DASG60-80-C-0016)
(AD-A091241) Avail: NTIS HC A10/MF A01 CSCL 09/2

This report documents the results to-date of the study titled Distributed Data Processing (DDP) Software/Hardware Support Plan in support of the Ballistic Missile Defense (BMD) Terminal Phase. This study was initiated mid-January 1980 and its purpose is to identify the capabilities required by BMD in order to have high confidence that full scale development (FSD) of a DDP subsystem can be initiated and completed within a short (3 to 4 year) time frame. The study is directed toward the definition of a DDP development facility for BMD that will help achieve the goal of a speedy development. The BMD DDP subsystem referred to in this report is assumed to be general in nature, i.e., its components may be hardware or software. Hardware components may be general purpose or specially developed for this application; they may already exist or are yet to be developed. Software components may consist of a combination of high order languages, assembly languages and microcoded modules. GRA

N81-13657# Stanford Univ., Calif. Dept. of Computer Science.

AN EXTENDED SEMANTIC DEFINITION OF PASCAL FOR PROVING THE ABSENCE OF COMMON RUNTIME ERRORS

Steven M. German Jun. 1980 62 p refs
(Contracts MDA903-80-C-0159; F30602-80-C-0022)
(AD-A091313; SU-STAN-CS-80-811; SPVG-Rept-18) Avail: NTIS HC A04/MF A01

We present an axiomatic definition of Pascal which is the logical basis of the Runcheck system, a working verifier for proving the absence of runtime errors such as arithmetic overflow, array subscripting out range, and accessing an uninitialized variable. Such errors cannot be detected at compile time by most compilers. Because the occurrence of a runtime error may depend on the values of data supplied to a program, techniques for assuring the absence of errors must be based on program specifications. Runcheck accepts Pascal programs documented with assertions, and proves that the specifications are consistent with the program and no runtime errors can occur. Our axiomatic definition is similar to Hoare's axiom system, but it takes into account certain restrictions that have not been considered in previous definitions. For instance, our definition accurately models uninitialized variables, and requires a variable to have a well defined value before it can be accessed. The logical problems of introducing the concept of uninitialized variables are discussed. Our definition of expression evaluation deals more fully with function calls than previous axiomatic definitions. Some generalizations of our semantics are presented, including a new method for verifying programs with procedure and function parameters. Our semantics can be easily adopted to similar languages, such as ADA. One of the main potential problems for the user of a verifier is the need to write detailed, repetitious assertions. We develop some simple logical properties of our definition which are exploited by Runcheck to reduce the need for such detailed assertions. GRA

N81-13658# Georgia Inst. of Tech., Atlanta. School of Information and Computer Science.

MUTATION ANALYSIS AS A TOOL FOR SOFTWARE QUALITY ASSURANCE Interim Technical Report

Richard A. DeMillo Oct. 1980 7 p refs
(Contracts DAAG29-80-C-0120; N00014-79-C-0231)
(AD-A090831; GIT-ICS-80/11) Avail: NTIS HC A02/MF A01 CSCL 09/2

A protocol for using mutation analysis as a tool for software

quality assurance is described. The results of experiments on the reliability of this method are also described. GRA

N81-13659# George Washington Univ., Washington, D.C. School of Engineering and Applied Science.
PROGRAM DESCRIPTION AND USER'S GUIDE FOR ZIPCAP: A ZERO-ONE INTEGER PROGRAM TO SOLVE MULTIACTIVITY MULTIFACILITY CAPACITY-CONSTRAINED ASSIGNMENT PROBLEMS
Krishan L. Chhabra and Richard M. Soland 1 Jul. 1980 71 p refs
(Contract N00014-75-C-0729)
(AD-A091127; SERIAL-T-423) Avail: NTIS HC A04/MF A01

ZIPCAP is a zero-one integer program developed to solve multiactivity multifacility capacity-constrained assignment problems. The objective in such problems is an assignment that minimizes the sum of the variable costs and fixed costs. This document describes ZIPCAP and provides guidelines for its use. Illustrative areas of application, program options, and test problems are included. GRA

N81-13660# Delaware Univ., Newark. Dept. of Computer and Information Sciences.
A CASE STUDY IN NATURAL LANGUAGE PROCESSING: THE RUS SYSTEM M.S. Thesis
Arthur William Mansky May 1980 123 p refs
(Contract F49620-79-C-0131; AF Proj. 2304)
(AD-A091043; AFOSR-80-1035TR) Avail: NTIS HC A06/MF A01 CSCL 09/2

The RUS system (Bobrow, 1978) is a new parser for English which allows semantically directed parsing by interleaving calls to a separate, independent semantic component with syntactic processing in a case-oriented ATN grammar. This thesis discusses the syntactic component (RUS), the points at which it calls a semantic component, and the nature of the syntactic-semantic interaction which occurs. The nature of the interaction, and the structure of the dictionary are the only assumptions placed on the semantic component. GRA

N81-13661# Brown Univ., Providence, R. I. Dept. of Computer Science.
INTERACTIVE COMPUTER GRAPHICS RESEARCH Final Report
Andries VanDam 24 Oct. 1980 11 p
(Contract N00014-75-C-0427)
(AD-A090949) Avail: NTIS HC A02/MF A01 CSCL 09/2

The goal of our research in distributed processing is to evolve fundamental concepts as well as implementation techniques for improving system performance by judicious runtime distribution of functions to processors and to levels of a hierarchical operating system. This distribution of computing tasks among the various processors in a network or among the many levels of a hierarchical operating system in a single computer is a critical issue in current and future military, industrial and educational computer systems. Our approach is to provide the applications programmer with tools that allow both the estimation of performance improvements of potential migrations, either horizontal (inter-processor) or vertical (intra-processor), and the implementation of the most promising migrations. GRA

N81-13662# Georgia Inst. of Tech., Atlanta. School of Information and Computer Science.
ON MUTATION Ph.D. Thesis
Allen Troy Acree, Jr. Aug. 1980 187 p refs
(Contracts DAAG29-80-C-0120; N00014-79-C-0231)
(AD-A091029; GIT-ICS-80/12) Avail: NTIS HC A09/MF A01 CSCL 09/2

Program Mutation is a method for testing computer programs which is effective at uncovering errors and is less expensive to apply than other techniques. Working mutation systems have demonstrated that mutation analysis can be performed at an attractive cost on realistic programs. In this work, the effectiveness of the method is studied by experiments with programs in the target application spaces. GRA

N81-13663# Mitre Corp., Bedford, Mass.
FY 79 SOFTWARE ACQUISITION PROCESS MODEL TASK; REVISION 1 Final Report
Oscar Shapiro and John B. Glore Jul. 1980 229 p refs
(F19628-80-C-0001; AF Proj. 5720)
(AD-A091031; MTR-3871-Rev-1; ESD-TR-80-129-Rev-1) Avail: NTIS HC A11/MF A01 CSCL 15/5

This final report on the FY 79 Project 5220 Software Acquisition Process Model Task (522F) presents the approach taken to process model definition, quantification, and simulation; accomplishments; and status at the fiscal year's end. The report also identifies desirable improvements and outlines a plan for their incorporation and application in successive process model versions. The report contains diagrams that represent the Full-Scale Development Phase of the Major System Acquisition Life Cycle. These diagrams can provide useful reference material for anyone who is (or expects to be) engaged in the planning or monitoring of a system development contract. Revision 1 eliminates references to several documents not in the public domain. These changes, made to secure public release, are all minor. In addition, minor errors have been corrected. GRA

N81-13664# California Univ., Berkeley. Lawrence Berkeley Lab. National Resource for Computation in Chemistry.
PROBLEM OF LONG-RANGE FORCES IN THE COMPUTER SIMULATION OF CONDENSED MEDIA
David Ceperely, ed. Jul. 1980 74 p refs Conf. held at Menlo Park, Calif., 8-11 Jan. 1980
(Contract W-7405-eng-48; Grant NSF CHE-77-21305)
(LBL-10634; CONF-800127; NRCC-9) Avail: NTIS HC A04/MF A01

Relating infinite system properties to the results of computer simulation involving relatively small numbers of particles, periodically replicated, raises difficult and challenging problems. Controlled studies of the long range forces problem in simulation of ionic and dipolar systems are presented. The effect of long range forces on the simulation of solvation and on biopolymer hydration is discussed, including Coulomb and hydrodynamic forces. Other topics include special techniques for long range force simulation. E.D.K.

N81-13665# National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.
COMPUTER SCIENCE AND TECHNOLOGY: A TESTBED FOR PROVIDING UNIFORMITY TO USER-COMPUTER INTERACTION LANGUAGES Final Report
Siegfried Treu Aug. 1980 78 p refs Prepared in cooperation with Pittsburgh Univ., Pa.
(PB80-215296; NBS-SP-500-63) Avail: NTIS HC A05/MF A01 CSCL 09B

The use of an intermediary processor to uniformize interaction languages is presented. A framework for such processing is characterized in terms of the required intermediary actions and the logical capabilities needed to perform those actions. The testbed software facilities are then portrayed. Throughout, an example application, using a common command language subset to access five bibliographic retrieval systems, is described. GRA

N81-13666# System Development Corp., McLean, Va.
COMMON COMMAND LANGUAGE FEATURE ANALYSIS
James Moulton Jun. 1980 141 p refs
(Contract NB79-SBCA-0274)
(PB80-211261; SDC-TM-WD-8036/101/01; ICST/HLNP-80-4; NBS-GCR-80-256) Avail: NTIS HC A07/MF A01 CSCL 09B

The access and management of files in a complex, heterogeneous computer network is addressed. A feature analysis of a standard language and its associated protocol is presented. In order to allow system independent manipulation of files and file management systems a common command language and a common command language protocol must be developed. The feature analysis results in the definition of plausible commands and functions that are candidates for inclusion in the service specification. These features are analyzed according to their applicability, usefulness, and cost. GRA

N81-13219*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A NOTE ON THE R SUB 0-PARAMETER FOR DISCRETE MEMORYLESS CHANNELS

R. J. McEliece *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 96-97 ref (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 09B

N81-13223*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
IMPLEMENTING THE UCSD PASCAL SYSTEM ON THE MODCOMP COMPUTER
T. Wolfe *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 121-125 refs (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 09B

N81-13225*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DSS COMMAND SOFTWARE UPDATE
W. G. Stinnett *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 132-134 (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 09B

62 COMPUTER SYSTEMS

Includes computer networks.

N81-13667 Iowa Univ., Iowa City.
FAULT DIAGNOSIS IN COMPUTING NETWORKS Ph.D. Thesis
Jon Gregory Kuhl 1980 177 p
Avail: Univ. Microfilms Order No. 8028275

The problem of diagnosis of failures in computing systems constructed as interconnections of discrete modules or units is considered. It is assumed that the modules in the network are capable of performing tests upon other modules, and also of being tested by other modules. Two classes of systems are considered, those which incorporate some central, or host facility, and those which are fully distributed. For the former class, extensions to existing system level fault diagnosis concepts are given, to allow the central facility to diagnose failures based on results collected from tests performed by the nodes of the system. For the class of fully distributed systems, a new diagnostic process, known as self diagnosability is proposed via which each node in a network can independently diagnose the condition of all other nodes in the system. The need for this type of diagnostic ability is argued via introduction of a notion called distributed fault tolerance. Dissert. Abstr.

N81-13668# Texas Univ. at Austin. Center for Cybernetic Studies.
RECENT DEVELOPMENTS IN COMPUTER IMPLEMENTATION TECHNOLOGY
Fred Glover and Darwin Klinsman Jul. 1980 36 p refs
(Contracts N00014-80-C-0242; N00014-78-C-0222)
(AD-A091215; CCS-377) Avail: NTIS HC A03/MF A01 CSCL 05/5

The application of computer implementation technology to network optimization has brought about unprecedented advances in solution efficiency. The remarkable gains of the early to mid 1970's for solving transportation and transhipment problems are widely known, enabling network codes to out-perform LP codes by two orders of magnitude for these problems. The pioneering study by Gilsinn and Witzgall demonstrated that effective use of computer implementation technology could reduce solution times for shortest path problems from one minute to slightly more than one second, using the same general shortest path algorithm, computer, and compiler. The momentum launched by these studies has not dwindled, but continues into the present. New advances in all areas of network optimization have recently superseded the procedures previously found to be best. Latest computer implementations clearly outstrip the best codes of the recent past as our understanding of the important relation between algorithmic design and implementation continues to grow. We undertake to report on some of the major computer implementation studies of the past few years and to present preliminary results on the new developments. GRA

N81-13669# Texas Univ. at Austin. Center for Cybernetic Studies.
A SUCCESSIVE SHORTEST PATH ALGORITHM FOR THE ASSIGNMENT PROBLEM
Michael Engquist Aug. 1980 35 p refs
(Contract N00014-75-C-0569; N00014-80-C-0242)
(AD-A091312; CCS-375) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this paper a new successive shortest path (SSP) algorithm for solving the assignment problem is introduced. A computer implementation of this algorithm has been developed and a discussion of the details of this implementation is provided. Computational results are presented which show this implementation of SSP to be substantially more efficient than several recently developed codes including the best primal simplex code. Also, some new theoretical results are presented which are useful in the implementation of SSP, and it is shown that the algorithm has a computational bound of O(n3), where n is the number of origins. GRA

N81-13670# Sandia Labs., Albuquerque, N. Mex.
PARAMETRIC INTEGER LINEAR PROGRAMMING: A SYNTHESIS OF BRANCH AND BOUND WITH CUTTING PLANES
Suzanne L. K. Rountree and Billy E. Gillett (Missouri Univ. - Rolla) 1980 17 p refs Presented at Conf. Sponsored by DOE
(SAND-80-2223C; CONF-801126-1) Avail: NTIS HC A02/MF A01

A branch and bound algorithm is designed to solve the general integer linear programming problem with parametric right hand sides. The method consists of first determining all possible right hand side integer constants and appending this set of integer constants to the initial tableau to form an expanded problem with a finite number of family members. The implicit enumeration method gives a lower bound on the integer solutions. The branch and bound method is used with fathoming tests which allow one family member possibly to fathom other family members. A cutting plane option applies a finite number of cuts to each node before branching. In addition, the cutting plane method is invoked whenever some members are feasible at a node and others are infeasible. The branching and cutting process is repeated until the entire family of problems has been solved. DOE

N81-13671# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
FORMAL DESCRIPTION TECHNIQUES FOR NETWORK PROTOCOLS
Jun. 1980 89 p refs Prepared in cooperation with System Development Corp., McLean, Va.
(Contract NB79-SBCA-0092)
(PB80-215700; ICST/HLNP-80-3; NBS-GCR-80-247) Avail: NTIS HC A05/MF A01 CSCL 09B

The National Bureau of Standards, Institute of Computer Sciences and Technology initiated a program to develop computer network protocol standards as Federal Information Processing Standards. One of a series of draft reports prepared under the network protocol standards program for distribution to government agencies, voluntary standards organizations, computer and communications equipment manufacturers, and other interested parties, the draft report contains two formal description techniques, a general survey, and a set of criteria for evaluation of these techniques. GRA

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N81-13672 Kentucky Univ., Lexington.
SOME RESULTS FOR QUEUING SYSTEMS WITH FEEDBACK Ph.D. Thesis
Peter William Hovey 1980 126 p
Avail: Univ. Microfilms Order No. 8027982

Some methods of dealing with queueing systems with delayed feedback are investigated. Single server queues with feedback

through a stochastic clearing process are investigated. Two types of clearing for the feedback mode are investigated. In the first, customers that feedback accumulate in a waiting area until the number in the waiting area reaches a specified level. In the other system, the feedback customers also accumulate in a waiting area. However, this waiting area is cleared at times determined by an exogenous Poisson process. The results for these two systems are somewhat similar. Foster's criteria are used to determine sufficient conditions for ergodicity of the two systems. Dissert. Abstr.

N81-13673*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
GLOBAL OPTIMALITY OF EXTREMALS: AN EXAMPLE
Eliezer Kreindler (Technion, Israel Inst. of Technology, Haifa) and Frank Newman Oct. 1980 23 p refs
(NASA-TM-81240; A-8347) Avail: NTIS HC A02/MF A01 CSCL 12A

The question of the existence and location of Darboux points is crucial for minimally sufficient conditions for global optimality and for computation of optimal trajectories. A numerical investigation is presented of the Darboux points and their relationship with conjugate points for a problem of minimum fuel, constant velocity, and horizontal aircraft turns to capture a line. This simple second order optimal control problem shows that ignoring the possible existence of Darboux points may play havoc with the computation of optimal trajectories. E.D.K.

N81-13674# Delaware Univ., Newark. Applied Mathematics Inst.
ASYMPTOTIC BEHAVIOR OF THE STATIONARY DISTRIBUTIONS IN THE GI/PHc QUEUE WITH HETEROGENEOUS SERVERS Interim Report
Marcel F. Neuts and Yukio Takahashi (Yohoku Univ.) May 1980 28 p refs
(Grants AF-AFOSR-3236-77; NSF ENG-79-08351; AF Proj. 2304)
(AD-A091036; TR-57B; AFOSR-80-0988TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper deals with the stable c-server queue with renewal input. The service time distributions may be different for the various servers. They are however all probability distributions of phase type. It is shown that the stationary distribution of the queue length at arrivals has an exact geometric tail of rate n, o - n - 1. It is further shown that the stationary waiting time distribution at arrivals has an exact exponential tail of decay parameter xi = 0. The quantities n and xi may be evaluated together by an elementary algorithm. For both distributions, the multiplicative constants which arise in the asymptotic forms may be fully characterized. These constants are however difficult to compute in general. GRA

N81-13675# Delaware Univ., Newark. Applied Mathematics Inst.
A PHASE TYPE, SEMI-MARKOVIAN POINT PROCESS Interim Report
Guy Latouche (Brussels Univ.) Apr. 1980 28 p refs
(Grants AF-AFOSR-3236-77; NSF ENG-79-08351; AF Proj. 2304)
(AD-A091037; TR-56B; AFOSR-80-0989TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

A semi-Markovian point process is defined, for which the intervals of time between successive events have phase type distribution. The distribution of the number of events in an interval is examined, and it is shown how the expected number of events in an interval may be efficiently computed. A stationary version of the process is analysed. In particular, the necessary and sufficient condition under which the new process is a renewal process is determined. Simple sufficient conditions are presented. GRA

N81-13676# Stanford Univ., Calif. Dept. of Computer Science.
BASIC RESEARCH IN ARTIFICIAL INTELLIGENCE AND FOUNDATIONS OF PROGRAMMING Final Report
John McCarthy, ed., Thomas Binford, David Luckham, Zohar Manna, Richard Weyhrauch, and Les Earnest May 1980 76 p refs
(Contract MDA903-76-C-0206; ARPA Order 2494)
(AD-A091183; SU-STAN-CS-80-808; AIM-337) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report describes recent research in several related areas. Basic research in artificial intelligence and formal reasoning addresses fundamental problems in the representation of knowledge and reasoning processes applied to this knowledge. Solution of these problems will make possible the development of analytical applications of computers with large and complex data bases, where current systems can handle only a very restricted set of data structures and queries. Mathematical theory of computation studies the properties of computer programs. The goal is to provide a sound theoretical basis for proving correctness or equivalence of designs. The goal of program verification is to improve the reliability of important classes of programs such as compilers, operating systems and realtime control systems, and to standardize techniques for program construction, documentation and maintenance. Image understanding is aimed at mechanizing visual perception of three-dimensional objects either from photographs or from passive imaging sensors. Advances in this field are expected to lead to much more efficient photointerpretation capabilities as well as automatic visual guidance systems. GRA

N81-13677# Naval Research Lab., Washington, D. C. Systems Research Branch.
PRECISE ANALYSIS OF AN OPTIMAL PERTURBATION ESTIMATION AND CONTROL PROBLEM Final Report
Warren W. Willman 15 Sep. 1980 82 p refs
(RR140241)
(AD-A091116; NRL-8406) Avail: NTIS HC A05/MF A01 CSCL 12/2

A mathematically rigorous analysis is performed of a scalar discrete-time stochastic optimal control problem. This problem differs from the standard linear-quadratic-Gaussian one only by the presence of a quadratic term in the state and process noise with a small coefficient. A certain formal approximation to the optimal control is shown to converge asymptotically in probability to an optimal control with respect to this coefficient. GRA

N81-13678# Sandia Labs., Albuquerque, N. Mex. Safeguards Methodology Dept.
DIGITAL SIMULATION AND MODELING OF NONLINEAR STOCHASTIC SYSTEMS
J. Mark Richardson and James R. Rowland (Oklahoma State Univ., Stillwater) 1980 16 p refs Presented at the IEEE Intern. Conf., Cambridge, Mass., Oct. 1980 Sponsored by DOE
(SAND-80-2080C; CONF-801049-2) Avail: NTIS HC A02/MF A01

Well-known numerical integration algorithms were shown not only to provide different solutions for the same stochastic system, but also to correspond to different stochastic integral definitions. These correspondences were proved by considering first and second moments of solutions resulting from different integration algorithms and comparing the moments to those arising from various stochastic integral definitions. Monte Carlo simulations and statistical tests were applied to illustrate the determining role which computational procedures play in generating solutions. This algorithm dependence of solutions is in sharp contrast to the deterministic and linear stochastic cases in which unique solutions are determined by any convergent numerical algorithm. Author

N81-13679# Systems Control, Inc., Palo Alto, Calif. Dept. of Operations Research.
ON THE DISTRIBUTION OF MULTIDIMENSIONAL REFLECTED BROWNIAN MOTION
J. Michael Harrison (Stanford Univ., Calif.) and Martin I. Reiman (Bell Telephone Labs., Inc., Holmdel, N.J.) Feb. 1980 45 p refs
(Grants NSF ENG-78-24568; NSF ENG-75-14847)
(PB80-211774; NSF/RA-800145; TR-79-030-3) Avail: NTIS HC A03/MF A01 CSCL 12B

The multidimensional diffusion process Z, simply called reflected Brownian motion, which arises in the heavy traffic theory for networks of queues is studied. Its state space is the K dimensional nonnegative orthant, where K is a positive integer. On the interior of this state space, Z behaves like an ordinary K

dimensional brownian motion with a given covariance matrix and drift vector. At each of the (K-1) dimensional hyperplanes that form the boundary of its state space, Z reflects instantaneously in a direction that is constant over that boundary hyperplane. The backward equation for the transition density function with boundary and initial conditions, the corresponding forward equation, and the equation for the steady state distribution are all derived formally. Various calculations are presented relating to steady state distributions, including a moment formula and the derivation of a condition involving the drifts and directions of reflection. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N81-13680 Maryland Univ., College Park.
A GENERALIZED ALTERNATIVE METHOD FOR BOUNDARY VALUE PROBLEMS WITH LARGE NONLINEARITIES Ph.D. Thesis
Jesus Rodriguez-Acosta 1980 54 p
Avail: Univ. Microfilms Order No. 8027135

A formalism for solving linear homogeneous boundary value problems in a Banach Space is developed. The main idea is to see under what conditions can the problem be reduced to a finite dimensional one. A general formalism is developed by which problems with large nonlinearities can be reduced to finite dimensional ones. Furthermore, a constructive procedure is developed which allows us to reduce a large class of boundary value problems in ordinary differential equations to the solution of a finite number of equations in a finite number of unknowns. Dissert. Abstr.

N81-13681 Maryland Univ., College Park.
NEWTON AND DAMPED NEWTON SCHEMES FOR SOLUTIONS OF SINGULAR BIFURCATION EQUATIONS Ph.D. Thesis
Arthur Wright Mansfield 1980 70 p
Avail: Univ. Microfilms Order No. 8027118

It is assumed that there exists a smooth m dimensional manifold of solutions where $m < k - 1$. In this case a damped Newton Scheme is developed provided the initial guess lies close enough to the manifold and not on a certain thin set. The necessity of avoiding this thin set is demonstrated in a numerical example. It is shown that if the dimension of the solution manifold is $k - 1$ the standard Newton Iteration Scheme will converge. The case arises if the differential equation possesses $k - 1$ linearly independent first integrals. Dissert. Abstr.

N81-13682# California Univ., Berkeley. Electronics Research Lab.
THE DISCRETE FOURIER TRANSFORM VIA CIRCULANTS
B. N. Parlett Aug. 1980 29 p refs
(Contract N00014-76-C-0013)
(AD-A090345; UCB/ERL-M80/37) Avail: NTIS HC A03/MF A01 CSCL 12/1

The discrete Fourier Transform (DFT) defined below is a valuable tool in many fields from signal processing to partial differential equations. There is strong incentive for computing the transform quickly, and, after two decades of active research, we now know the minimum number of essential multiplications required for the task and have algorithms which use precisely this number. It does not follow that, in the end, these will be the most desirable techniques but they are certainly of interest in their own right. This story, and more, is told in the book. GRA

N81-13683# Rome Air Development Center, Griffiss AFB, N.Y.
THE DERIVATION OF A MULTIVARIATE PROBABILITY DENSITY FUNCTION HAVING AN EXPONENTIAL-TYPE BIVARIATE MARGINAL DENSITY
John F. Lennon Apr. 1980 32 p refs
(AF Proj. 2305)
(AD-A091110; RADC-TR-80-153) Avail: NTIS HC A03/MF A01 CSCL 20/3

For the calculation of electromagnetic scattering from rough terrain, relations have been established between the scattering cross section and the statistical characterization of the surface. These relations are based on the assignment of a bivariate probability density to the observed surface heights at any two points of a region. To implement a scattering calculation in a region, joint probability density functions that will reduce to appropriate bivariate marginal densities are associated with the distribution of heights in the area. In some instances, however, the required form of the multivariate probability density is not evident, since the original form is not necessarily preserved as successive marginal densities are formed. This report describes the procedures used to determine the multivariate probability density function that reduces to the particular bivariate exponential marginal density form having a known correspondence to electromagnetic scattering. Expressions are given both for the multivariate probability density and for the associated marginal densities of any order. GRA

N81-13684# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
LINEAR MULTISTEP METHODS WITH NEAR-OPTIMAL STABILITY Ph.D. Thesis - Missouri Univ.
David Jerome Nolting Dec. 1979 108 p refs
(AD-A091008; AFIT-CI-79-244D) Avail: NTIS HC A06/MF A01 CSCL 12/1

Desirable properties of linear multistep methods (LMM) can be optimized by viewing those properties as functional values and the LMM possessing those properties as points in a domain space. This study conducts two such optimizations numerically. The first is a search for relatively stable explicit LMM and the second is a search for stiffly stable implicit LMM. Near optimally relatively stable explicit LMM are found for orders four through nine. In the second study, the concept of A(alpha, r)-stability is introduced for stiffly stable LMM. It recognizes the need for large regions of absolute stability in the left half plane and the need for a region of accuracy about the origin defined by the region of relative stability. An economical means of determining the region of relative stability is developed and used. GRA

N81-13685# Stanford Univ., Calif. Dept. of Computer Science.
COMPUTATIONAL USES OF THE MANIPULATION OF FORMAL PROOFS Ph.D. Thesis
Christopher Alan Goad Aug. 1980 132 p refs
(Contract MDA903-80-C-0102; ARPA Order 2492)
(AD-A091180; Su-STAN-CS-80-819) Avail: NTIS HC A07/MF A01 CSCL 12/1

This thesis concerns computational uses of the additional information contained in proofs, and efficient methods for the representation and transformation of proofs. An extended lambda-calculus is presented which allows compact expression of the computationally significant part of the information contained in proofs. Terms of the calculus preserve dependency data, but can be efficiently executed by an interpreter of the kind used for lambda-calculus based languages such as LISP. The calculus has been implemented on the Stanford Artificial Intelligence Laboratory PDP-10 computer. Results of experiments on the use of pruning transformations in the specialization of a bin-packing algorithm are reported. GRA

N81-13686# Texas Univ., Austin. Center for Cybernetic Studies.
AN ALGORITHM FOR A LEAST ABSOLUTE VALUE REGRESSION PROBLEM WITH BOUNDS ON THE PARAMETERS
Ronald Armstrong (York Univ., Downsview, Ontario) and Mabel Kung Jun. 1980 23 p refs
(Contracts N00014-75-C-0569; N00014-80-C-0242; NR Proj. 047-021; NR Proj. 047-071)
(AD-A091216; CSS-378) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper presents a special purpose linear programming algorithm to solve a least absolute value regression problem with upper and lower bounds on the parameters. The algorithm exploits the problem's special structure by maintaining a compact representation of the basis inverse and by allowing for the capability to combine several simplex iterations into one.

Computational results with a computer code implementation of the algorithm is given. GRA

N81-13687# Stanford Univ., Calif. Dept. of Electrical Engineering.

A NEW ALGORITHM TO PERFORM LU DECOMPOSITION WITH APPLICATIONS IN 2-D DIGITAL FILTERING Interim Report

Ph. Delsarte, Y. Genin, and Y. Kamp 1980 4 p refs Presented at the IEEE Intern. Symp. on Circuits and Systems, Houston, Tex., Apr. 1980

(Contracts F49620-79-C-0058; DAAG29-79-C-0215; AF Proj. 2304)

(AD-A091184; AFOSR-80-0807TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

A new inversion algorithm is described whose complexity is problem-dependent and strongly depends on how close to the Toeplitz structure the system matrix considered is. The algorithm yields spontaneously to an efficient parallel computation implementation, takes advantage of a possible sparsity of the system matrix and has natural application in two-dimensional digital filtering. T.M.

N81-13688# Ballistic Research Labs., Aberdeen Proving Ground, Md.

USER'S MANUAL FOR THE BRL SUBROUTINE TO EVALUATE SINE, COSINE, AND EXPONENTIAL INTEGRALS FOR COMPLEX ARGUMENT

James N. Walbert and Emma M. Wineholt Aug. 1980 72 p refs

(DA Proj. 1L1-61102-AH-43)

(AD-A091247; AD-E430514; ARBRL-TR-02255) Avail: NTIS HC A04/MF A01 CSCL 09/2

The formulas used in the BRL Sine, Cosine and Exponential Integral subroutine are derived in sufficient detail to enable the user to correctly implement the computer code. Estimates of precision, sample output, and an annotated listing of the computer code are included in the appendices. GRA

N81-13689# Center for Naval Analyses, Alexandria, Va. Naval Warfare Analysis Group.

ON THE WKB APPROXIMATION TO THE PROPAGATOR FOR ARBITRARY HAMILTONIANS

Maurice M. Mizrahi Aug. 1980 28 p refs

(AD-A091307; CNA-PP-286) Avail: NTIS HC A03/MF A01 CSCL 12/1

The purpose of this paper is to obtain a general expression for the WKB approximation to the propagator corresponding to an arbitrary Hamiltonian operator. In an earlier publication we determined a range of validity of Van Vleck's well-known formula, which was known not to be universally valid. The approximation derived here, generalizing Van Vleck's formula, is also valid beyond quantum-mechanical applications such as the Fokker-Planck equation for diffusion processes. We operate in n dimensions and summation over repeated indices is implied. GRA

N81-13690# Naval Ocean Systems Center, San Diego, Calif. Electronics Div.

A LEAST SQUARES ADAPTIVE LATTICE EQUALIZER ALGORITHUM Technical Report, Oct. 1978 - Sep. 1979

E. H. Satorius and J. D. Pack 2 Sep. 1980 23 p refs

(ZR0140811)

(AD-A091346; NOSC/TR-575) Avail: NTIS HC A02/MF A01 CSCL 12/1

In many applications of adaptive data equalization, rapid initial convergence of the adaptive equalizer is of paramount importance. Apparently the fastest known equalizer adaptation algorithm is based on a least squares estimation algorithm. The least squares algorithm, which is a special case of the Kalman estimation algorithm, was first applied to channel equalization by Godard in a seminal paper. One disadvantage with the Godard algorithm is that the complexity, i.e., number of additions and multiplications, of the algorithm grows quadradically with the number of filter coefficients. Recently, however, Morf, Ljung, Lee and others have shown how the complexity of the conventionally implemented least squares algorithms (e.g., Godard's algorithm) can be made to grow only linearly with the number of filter coefficients. Furthermore, these computationally simpler least squares algorithms may be implemented either in tapped delay line or lattice form. The application of the tapped delay line form, i.e., the fast Kalman algorithm, to channel equalization has been considered recently by Falconer and Ljung. In this paper, it is shown how the least squares lattice algorithms originally introduced by Morf and Lee can be adapted to the equalizer adjustment algorithm. The extremely rapid start up convergence properties of the least squares lattice equalizer are confirmed by computer simulation. GRA

N81-13691# Wisconsin Univ. - Madison. Mathematics Research Center.

A POPULATION OF LINEAR, SECOND ORDER ELLIPTIC PARTIAL DIFFERENTIAL EQUATIONS ON RECTANGULAR DOMAINS, PART 2

John R. Rice, Elias N. Houstis, and Wayne R. Dyksen May 1980 156 p

(Contracts DAAG29-80-C-0041; DAAG29-75-C-0024; Grants NSF MCS-77-01408; NSF MCS-79-01437)

(AD-A090825; MRC-TSR-2079) Avail: NTIS HC A08/MF A01 CSCL 12/1

This report contains the machine readable form of the 189 partial differential equations presented in MRC Technical Summary Report No. 2078 'A population of linear, second order, elliptic partial differential equations on rectangles - part 1.' These are two large files: EQNFIL contains 189 entries which are either complete statements of a PDE in the ELLPACK language or a reference to an entry in MACFIL with parameter values given. MACFIL contains the 42 parameterized PDE's in a form suitable for automatically substituting in parameter values. A few other small files are given to facilitate using this problem population within the ELLPACK system. GRA

N81-13692# Stanford Univ., Calif. Dept. of Computer Science.

RECENT DEVELOPMENTS IN THE COMPLEXITY OF COMBINATORIAL ALGORITHMS

Robert Endre Tarjan Jun. 1980 31 p refs Presented at the 5th IBM Symp. on Foundations of Computer Sci., Hakone, Japan, 26-28 May 1980

(Contract N00014-76-C-0330; Grant NSF MCS-78-26858)

(AD-A091122; SU-STAN-CS-80-794) Avail: NTIS HC A03/MF A01 CSCL 12/1

Several major advances in the area of combinatorial algorithms include improved algorithms for matrix multiplication and maximum network flow, a polynomial time algorithm for linear programming, and steps toward a polynomial time algorithm for graph isomorphism. This paper surveys these results and suggests directions for future research. Included is a discussion of recent work by the author and his students on dynamic dictionaries, network flow problems, and related questions. GRA

N81-13693# Stanford Univ., Calif. Dept. of Computer Science.

LOWER BOUNDS FOR ALGEBRAIC DECISION TREES

J. Michael Steele and Andrew C. Yao Jul. 1980 14 p refs

(Contract N00014-76-C-0475; Grant NSF MCS-77-05313; NR Proj. 042-267)

(AD-A091124; SU-STAN-CS-80-810) Avail: NTIS HC A02/MF A01 CSCL 12/1

A topological method is given for obtaining lower bounds for the height of algebraic decision trees. The method is applied to the knapsack problem where an (Omega) (n squared) bound is obtained for trees with bounded-degree polynomial tests, thus extending the Dobkin-Lipton result for linear trees. Applications to the convex hull problem and the distinct element problem are also indicated. Some open problems are discussed. GRA

N81-13694# Stanford Univ., Calif. Dept. of Computer Science.

PATH-REGULAR GRAPHS

David W. Matula and Danny Dolev Jun. 1980 42 p refs

(Contract N00014-76-C-0330; Grant NSF MCS-77-23738)

(AD-A091123; SU-STAN-CS-80-807) Avail: NTIS HC A03/MF A01 CSCL 12/1

A graph is vertex-(edge-)path-regular if a list of shortest paths, allowing multiple copies of paths, exists where every pair

of vertices are the end vertices of the same number of paths and each vertex (edge) occurs in the same number of paths of the list. The dependencies and independencies between the various path regularity, regularity of degree, and symmetry properties are investigated. We show that every connected vertex-(edge-)symmetric graph is vertex-(edge-)path-regular, but not conversely. We show that the product of any two vertex-path-regular graphs is vertex-path-regular but not conversely, and the iterated product GxGx...xG is edge-path-regular if and only if G is edge-path-regular. An interpretation of path-regular graphs is given regarding the efficient design of concurrent communication networks. GRA

N81-13695# Sandia Labs., Albuquerque, N. Mex. Applied Mathematics Div.

SURVEY OF NUMERICAL METHODS FOR ORDINARY DIFFERENTIAL EQUATIONS

H. A. Watts May 1980 40 p refs Presented at Conf. on Elec. Power Probl.: The Math. Challenge, Seattle, 18-20 Mar. 1980

(Contract DE-AC04-76DP-00789)

(SAND-79-2476) Avail: NTIS HC A03/MF A01

Progress in the numerical solution of initial value problems for ordinary differential equations is discussed. Algorithmic and software advances, leading to code improvements in the areas of overall efficiency, reliability, robustness, and convenience are cited. Drawbacks in the solution of stiff problems are discussed and emphasis is given to methods and codes aimed at solving stiff problems. J.M.S.

N81-13696# Sandia Labs., Livermore, Calif. Applied Mathematics Div.

AUTOMATIC SELECTION OF METHODS FOR SOLVING STIFF AND NONSTIFF SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS

Linda Petzold Sep. 1980 47 p refs Sponsored by DOE

(SAND-80-8230) Avail: NTIS HC A03/MF A01

A scheme is described for automatically determining whether a problem can be solved more efficiently using a class of methods suited for nonstiff problems or a class of methods designed for stiff problems. The technique uses information that is available at the end of each step in the integration for making the decision between the two types of methods. If a problem changes character in the interval of integration, the solver automatically switches to the most efficient class of methods for that part of the problem. Test results, using a modified version of the GEAR package, indicate that many problems can be solved more efficiently using this scheme than with a single class of methods, and that the overhead of choosing the most efficient methods is relatively small. DOE

N81-13697# Sandia Labs., Albuquerque, N. Mex.

LATIN HYPERCUBE SAMPLING FOR THE SIMULATION OF CERTAIN NONMONOTONIC RESPONSE FUNCTIONS

Kathleen Vickers Fiegert and Carl Diegert 1980 16 p refs Presented at Conf. Sponsored by DOE

(SAND-80-1861C; CONF-800820-8) Avail: NTIS HC A02/MF A01

The latin hypercube sampling, LHS, plan is presented as an alternative to simple random sampling, SRS, in Monte Carlo studies. For each realization of random input vector X, suppose that a computer code produces a scalar output Y=h(X). When h is monotonic in each of its arguments, some common summary statistics on Y are more efficient under LHS than under SRS. This monotonicity restriction on h excludes some interesting response functions. For example, suppose X is a vector of a mission's sensor measurements, and Y=h(X) is one when the mission is successful and zero otherwise. Function h is not monotonic in a common case; it is not monotonic if success occurs when X is near the true value, and failure occurs when X departs sufficiently from this value in any direction. Conditions on h are given, general enough to include this setting, under which LHS produces more efficient estimates than SRS. Author

N81-13698# California Univ., Berkeley. Dept. of Electrical Engineering and Computer Sciences.

ASYMPTOTIC UNBOUNDED ROOT LOCI BY THE SINGULAR VALUE DECOMPOSITION

S. S. Sastry and C. A. Desoer 1979 52 p refs Presented at the NATO-AMS Summer Seminar on Geometric and Algebraic Methods in Linear System Theory, Cambridge, Mass., 18-29 Jun. 1979

(Grant NSF ENG-76-85422)

(PB80-222490; NSF/RA-790506) Avail: NTIS HC A04/MF A01 CSCL 12A

The asymptotic behavior of the closed loop eigenvalues (root loci) of a strictly proper linear time invariant control system as the loop gain goes to infinity is studied. Basic properties of the singular value decomposition are introduced and then used to obtain formulas for the asymptotic values, as the loop gain goes to infinity, of the unbounded (with loop gain) root loci. The geometric interpretation of these formulas is developed and a numerically sound way of computing them is proposed. To obtain the complete asymptotes of the unbounded root loci, perturbation techniques are used under mild assumptions. Necessary and sufficient conditions for the closed loop exponent stability of a strictly proper linear time invariant system under arbitrarily high feedback gain are derived by using these calculations. GRA

N81-13699# National Oceanic and Atmospheric Administration, Washington, D. C. Environmental Data and Information Service.

ACCURATE LEAST-SQUARES TECHNIQUES USING THE ORTHOGONAL FUNCTION APPROACH

Jerry Sullivan Mar. 1980 112 p refs

(PB80-223241; NOAA-TR-EDIS-33; NOAA-80071404) Avail: NTIS HC A06/MF A01 CSCL 12A

The orthogonal function approach to the least-squares method is presented. It provides accurate numerical results, even when used on large data sets. It is useful in theoretical considerations, particularly in examining the statistical structure of a data set. The Gram-Schmidt orthogonal function approach is compared to the standard least-squares method. Properties of the approach are shown and a technique to enhance its numerical accuracy is given. Statistical aspects are discussed. Some applications of the approach are illustrated. A method used when the functions fitted to the data are polynomials is described, and a related application to Fourier analysis is included. GRA

N81-13700 New York Univ., N. Y.

AN EXPOSITION OF THE CONFORMAL MAPPING OF RIEMANN SURFACES: CERTAIN TOPOLOGICAL, FUNCTION THEORETIC AND NUMERICAL ASPECTS Ph.D. Thesis

Philip William Caverly 1980 275 p

Avail: Univ. Microfilms Order No. 8027433

The concept of a Riemann surface is developed in the search for a method to represent elementary multi-valued analytic functions. Emphasis is placed, throughout, on examples, in particular the multi-valued functions $w = 2(1/2)$ and Log z and the Riemann surfaces: the sphere, the plane, and the disc. The fundamental group and covering transformation of the Riemann surfaces are defined and applied in analyzing various Riemann surfaces. The automorphisms for specific surfaces are calculated. The connection between conformal, quasi-conformal mapping and Tiechmuller spaces is developed. A complete proof of the Uniformization Theorem, classifying all Riemann surfaces into three mutually distinct classes is presented. The Green's function is constructed for regions on Riemann surfaces and the conformal mapping function is constructed. A numerical example is given of a conformal mapping of a hyperbolic Riemann surface onto a hyperbolic Riemann surface. Dissert. Abstr.

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N81-13701 Kentucky Univ., Lexington.

THE SIMPLEX SEARCH IN STATISTICAL OPTIMIZATION PROBLEMS Ph.D. Thesis

Robert James Craig 1980 130 p

Avail: Univ. Microfilms Order No. 8027975

The general notion of a simplex search is reviewed, and shown to provide a method of solving some of the problems presented specifically in statistical applications. In addition several modifications of the basic simplex search including the Nelder-Mead procedure are discussed. This leads to consideration of the problems which present simplex searches have including slow convergence in higher dimensions and convergence problems on functions which are badly scaled in the parameters. Several modifications to the Nelder-Mead procedure are developed for helping simplex searches solve the dimensionality and scaling problems, and each of these procedures is tested on a wide variety of standard optimization test problems. The simplex search is then developed for a specific statistical application, nonlinear least squares. Procedures are discussed that make the simplex search quadratically convergent and provide an estimate of the variance covariance matrix. Then several simplex search type procedures for nonlinear least squares estimation are tested. Dissert. Abstr.

N81-13702 Rochester Univ., N. Y.
EMPIRICAL BAYES, JAMES STEIN AND RIDGE REGRESSION TYPE ESTIMATORS FOR LINEAR MODELS Ph.D. Thesis
Marvin Haskel Jack Gruber 1979 367 p
Avail: Univ. Microfilms Order No. 8027720

Bayes and empirical Bayes estimators are formulated for estimable functions of the parameters of non-full rank linear models. Ridge and contraction estimators are shown to be special cases of Bayes estimators. The mean square errors of Bayes estimators for estimable functions are compared with those of the least square estimators. Some general results for comparison of the prediction error of two Bayes estimators are obtained. For one and for r linear models, empirical Bayes estimators are formulated. These estimators include various James Stein estimators. Mean square errors are evaluated with and without averaging over the prior distribution. Comparisons of the efficiencies of the various estimators are made. The empirical Bayes estimators are shown to be approximate Minimum Mean Square Error estimators. Some of the results obtained for univariate models are extended to multivariate models. A way to formulate more efficient ridge estimators is given for a Seemingly Unrelated Regression Equation model. Dissert. Abstr.

N81-13703# Delaware Univ., Newark. Applied Mathematics Inst.
AN ILLUSTRATIVE PROBLEM IN COMPUTATIONAL PROBABILITY Interim Report
Marcel F. Neuts Jun. 1980 11 p refs Presented at the 1st Conf. of the Indian Soc. for the Theory of Probability and its Appl., Tirupati, 8-10 Jul. 1980
(Grants AF-AFOSR-3236-77; NSF ENG-79-08357; AF Proj. 2304)
(AD-A091035; TR-60B; AFOSR-80-0987TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

An elementary, but useful problem in reliability design is used to illustrate some of the principles and concerns of computational probability. A number n of items with exponential life time are placed in parallel. The time until all items have failed is denoted by U sub n. It is desirable that U sub n exceed the duraction T, where T is a random variable, independent of the n life times. We wish to determine the smallest value of n for which P(U sub n = T) exceeds 1 - epsilon. It is shown that if T has a delayed distribution of phase type, this may be done by a recursive algorithm, which avoids numerical integrations. GRA

N81-13704# South Carolina Univ., Columbia. Dept. of Mathematics and Statistics.
SOME STRONG AND WEAK LAWS OF LARGE NUMBERS IN D(0,1) Interim Report
Peter Zito Daffer and Robert Lee Taylor Jul. 1980 45 p refs Prepared in cooperation with Louisiana Tech Univ., Ruston
(Contract F49620-79-C-0140)
(AD-A091086; TR-57; AFOSR-80-1004TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

Strong laws of large numbers for a sequence x sub n of random functions in D(0,1) are derived using new pointwise conditions on the first absolute moments, which improve on known results. In particular, convex tightness is not implied by the hypotheses of the theorems. It is shown that convex tightness is preserved when random functions are centered, and this result is applied to improve some known strong laws for weighted sums in D(0,1). A weak law of large numbers is proved using a new pointwise condition on the first moments and some weak laws for weighted sums are improved upon by weakening the hypotheses. A study is made of relationships among several conditions on X sub n which appear as hypotheses in laws of large numbers. GRA

N81-13705# Pittsburgh Univ., Pa. Inst. for Statistics and Applications.
INFERENCE ON THE STRUCTURE OF INTERACTION IN TWO-WAY CLASSIFICATION MODEL Interim Report
P. R. Krishnaiah and M. G. Yochmowitz Jul. 1980 40 p refs
(Contract F49620-79-C-0161; AF Proj. 2304)
(AD-A091034; TR-80-8; AFOSR-80-0986TR) Avail: NTIS HC A03/MF A01 CSCL 06/3

In this report, the authors give a review of the literature on tests for studying the structure of interaction in two-way classification with one observation per cell. Special emphasis is made on simultaneous test procedures. GRA

N81-13706# Pittsburgh Univ., Pa. Inst. for Statistics and Applications.
DIVERSITY AND DISSIMILARITY COEFFICIENTS: A UNIFIED APPROACH Interim Report
C. Radhakrishna Rao Jul. 1980 36 p refs
(Contract F49620-79-C-0161; AF Proj. 2304)
(AD-A091033; TR-80-10; AFOSR-80-0984TR) Avail: NTIS HC A03/MF A01 CSCL 06/3

Three general methods for obtaining measures of diversity within a population and dissimilarity between populations are discussed. One is based on an intrinsic notion of dissimilarity between individuals and others make use of the concepts of entropy and discrimination. A criterion is developed for choosing a measure of diversity in a given class of measures. The Gini-Simpson index of diversity is derived as the solution to a functional equation. GRA

N81-13707# Maryland Univ., College Park. Computer Science Center.
FITTING RANDOM FIELD MODELS TO IMAGES Interim Report
R. Chellappa Aug. 1980 42 p refs
(Grant AF-AFOSR-3271-77; AF Proj. 2304)
(AD-A091044; CSC-TR-928; AFOSR-80-1037TR) Avail: NTIS HC A03/MF A01 CSCL 05/8

This paper deals with fitting two-dimensional stationary random field (RF) models to images. We assume that the given image is represented on a torus lattice, obeying an R.F. model driven by uncorrelated noise. The stochastic model is characterized by a set of unknown parameters. We describe two sets of experimental results. First, by assigning values to parameters in the stationary range, two dimensional patterns are generated. It appears that quite a variety of patterns can be generated. Next we consider the problem of estimating the parameters, given an arbitrary image. By assuming a Gaussian structure for the noise, we give an iterative scheme to estimate the unknown parameters. We also implement a decision rule to choose an appropriate set of neighbors for the image. The theory is illustrated by applying it to synthetic patterns. GRA

N81-13708# Florida State Univ., Tallahassee. Dept. of Statistics.
THE INFLUENCE OF THE SAMPLE ON THE POSTERIOR DISTRIBUTION Interim Report
Salwa Fahmy, Carlos A. B. Pereira, and Frank Proschan Apr. 1980 14 p Sponsored in part by CAPES and USP-Brasil
(Grant AF-AFOSR-3678-78; AF Proj. 2304)
(AD-A091026; FSU-STATISTICS-M545; AFOSR-80-0995TR; AFOSR-78-107TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

In this paper, we present conditions on the likelihood function and on the prior distribution which permit us to assess the effect of the sample on the posterior distribution. Our work is inspired by Whitt (1979) J. Amer. Statist. Assoc. 74, and is

based on the notion of multivariate totally positive functions introduced by Karlin and Rinott (1980), unpublished report. GRA

N81-13709 Kentucky Univ., Lexington.
ON THE USE OF PRIOR INFORMATION FOR PREDICTION Ph.D. Thesis
David Charles Jordan 1980 213 p
Avail: Univ. Microfilms Order No. 8027986

A series of soil fertility experiments was divided into two sets based on the value of total soil nitrogen at each site. The objective was assumed to be to transfer experimental results from one region to the other via a regression model based on data obtained at one set of sites. After hypothesizing certain prior information about the parameters of the model, Bayesian estimators were obtained as well as Ridge estimators of the parameters corresponding to several values for the share of sample information in the posterior knowledge of these estimators. For each value of this measure which was considered, the total posterior variance and residual sum of squares associated with predictions of yields in the second set were, in comparison with corresponding values for Ridge, considerably lower when using prior information. Dissert. Abstr.

N81-13710 Georgia Univ., Athens.
ERROR ESTIMATES FOR GAUSSIAN QUADRATURE FORMULAS AND APPLICATIONS Ph.D. Thesis
Tsann-Hoa Charles Chen 1980 80 p
Avail: Univ. Microfilms Order No. 8029109

The notion that derivative-free asymptotic error estimates may be obtained for the Gauss-Legendre quadrature formula is extended to certain non-classical weight functions. Applications include: (1) investigation of the ratio of errors of the modified quadrature rule, introduced for functions with near by poles, and its Gaussian counterpart; (2) estimates for Fourier coefficients relative to certain non-classical weight functions; and (3) estimates for the error coefficients introduced in finding upper bounds for Gaussian quadrature errors. Dissert. Abstr.

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N81-13711# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
ENLARGING THE REGION OF CONVERGENCE OF NEWTON'S METHOD FOR CONSTRAINED OPTIMIZATION
Dimitri P. Bertsekas Mar. 1980 41 p refs
(Grant NSF ENG-79-06332)
(PB80-219215; LIDS-R-985; NSF/RA-800146; OSP-87649)
Avail: NTIS HC A03/MF A01 CSCL 12B

Newton's method for solving the system of necessary optimality conditions of optimization problems with inequality constraints is considered. The principal drawbacks of the method are the need for a good starting point, the inability to distinguish between local maxima and local minima, and when inequality constraints are present, the necessity to solve a quadratic programming problem at each iteration. Extensions to inequality constraints are based on the use of penalty functions by converting inequality constraints to equality constraints through the use of squared slack variables. The resulting Newton-like methods use systems of linear equations involving only the active and nearly active constraints. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N81-13712 California Univ., Davis.
CIRCULAR OPERATORS Ph.D. Thesis
Earl Eugene Kymala 1980 52 p
Avail: Univ. Microfilms Order No. 8027065

Circular and essentially circular operators on a separable Hilbert space are discussed. A circular operator is an operator B such that B is unitarily equivalent to zeta B for all complex numbers zeta of modulus 1. An essentially circular operator is a compact perturbation of a circular operator. Irreducible circular operators are the operators B for which there exists a strongly continuous unitary representation U sub zeta of the circle group such that U zeta BU zeta = zeta B. If this representation has a cyclic vector, then B is a shift. As an example, it is shown that Bishop operators are not circular, however, they are essentially circular. A Bishop operator is, in fact, a compact perturbation of weighted bilateral shift. It is demonstrated that for certain covariance algebras there exist representations that are essentially equivalent to the identity representation. Dissert. Abstr.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N81-13713# California Univ., Livermore. Lawrence Livermore Lab.
RELIABILITY OF LARGE SUPERCONDUCTING MAGNETS THROUGH DESIGN
Carl D. Henning Sep. 1980 9 p refs Presented at the Appl. Superconductivity Conf., Santa Fe, N. Mex., 29 Sep. - 2 Oct.
(Contract W-7405-eng-48)
(UCRL-84110; CONF-800980-3) Avail: NTIS HC A02/MF A01

As superconducting magnet systems grow larger and become the central component of major systems involving fusion, magnetohydrodynamics, and high energy physics, their reliability must be commensurate with the enormous capital investment in the project. Creative design is the most effective way of ensuring magnet reliability and providing a reasonable limit on the amount of quality control needed. By subjecting the last drawing operation in superconductor manufacture to a stress larger than the magnet design stress, a 100 percent proof test is achieved; cabled conductors offer mechanical redundancy, as do some methods of conductor joining; ground plane insulation should be multilayered to prevent arcs, and interturn and interlayer insulation spaced to be compatible with the self-extinguishing of arcs during quench voltages; electrical leads should be thermally protected; and guard vacuum spaces can be incorporated to control helium leaks. DOE

N81-13714 Northwestern Univ., Evanston, Ill.
MAGNETIC PROPERTIES OF VO2 AND VO2 DOPED WITH TUNGSTEN AND MOLYBDENUM Ph.D. Thesis
Thomas Joseph Langill 1980 111 p
Avail: Univ. Microfilms Order No. 8026848

Polycrystalline powders of VO2 and of VO2 doped with tungsten molybdenum and rhenium along with VO1995 and VO2005 were studied magnetically in the temperature region from 1.74 to 295 K. Initial susceptibility measurements were recorded over the temperature range for a wide range of sample compositions. EPR experiments were conducted at 4.2.77 and 295 K measure the spectroscopic splitting factors. Tungsten doped VO2 showed a Curie-Weiss law behavior in the magnetic susceptibility measurements. Pure VO2 has a temperature independent magnetic susceptibility behavior below (+) with a slight paramagnetic value likely due to conduction electron effect. The molybdenum and rhenium dope samples exhibit the same low temperature behavior as pure VO2. Magnetization versus applied magnetic field curves were measured for all samples at 1.74, 2.15 and 4.20K out to fields of 7000 Oe. The M versus H curves for tungsten doped VG showed considerable curvature indicating the presence of large antiferromagnetic clusters. The molybdenum and rhenium doped samples showed very slight curvature in the M versus H plots similar to the pure VO2 curves. Dissert. Abstr.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N81-13715 Illinois Univ. at Urbana-Champaign.
SCATTERING MATRIX ANALYSIS OF SURFACE ACOUSTIC WAVE REFLECTORS AND TRANSDUCERS Ph.D. Thesis
Carl Michael Panasik 1980 65 p
Avail: Univ. Microfilms Order No. 8026568

Phased periodic array scattering parameters were modified and corrected for use as a single electrode, mixed units, scattering matrix consisting of one electrical and two acoustic ports. These scattering parameter analytical expressions are functions of material constants, electrode geometry, and frequency. The three port single electrode scattering matrices are acoustically cascaded to produce a three port device scattering matrix which takes into account all finger interactions (acoustic and electric) for the combined effects of piezoelectric and mechanical scattering. The analysis agrees well with experimental measurements of input admittance, electro-acoustic transfer function, and acoustic transmission and reflection coefficients as functions of frequency. Analysis results for the complete modeling of transducers with floating electrodes are also presented. Dissert. Abstr.

N81-13716# Rome Air Development Center, Griffiss AFB, N.Y.
MICROWAVE ACOUSTICS HANDBOOK. VOLUME 3: BULK WAVE VELOCITIES Report, Nov. 1971 - Apr. 1980
A. J. Slobodnik, Jr., R. T. Delmonico, and E. D. Conway May 1980 530 p refs
(AF Proj. 2305)
(AD-A090947; RADC-TR-80-188-Vol-3) Avail: NTIS HC A23/MF A01 CSCL 20/1

Information useful for the design of acoustic delay lines, resonators, and other miniature, low cost, reliable devices for use in communications and electronic sensing is given in this report. Computations of bulk acoustic wave velocities, power flow angles, and coupling to electric fields are plotted for various orientations of the following single crystalline materials: Ba2-NaNb5O15, Bi12GeO20, CdS, Diamond, Eu3Fe5O15, Gadolinium Gallium Garnet, GaAs, Germanium, InSb, InAs, Lead Molybdate, PbS, LiNbO3, LiTaO3, MgO, Quartz, Rutile, Sapphire, Silicon, Spinel, TeO2, YAG, YGaG, YIG, and ZnO. Particular cuts of interest, including cases for common metals, are then chosen for more detailed numerical calculations of mechanical and electrical parameters governing acoustic wave propagation in these media. A list of material constants is also included. GRA

N81-13717# Federal Aviation Administration, Washington, D.C. Office of Environment and Energy.
NOISE LEVELS AND DATA CORRECTION ANALYSIS FOR SEVEN GENERAL AVIATION PROPELLER AIRCRAFT Final Report
David W. Ford and Edward J. Rickley Sep. 1980 376 p refs
(AD-A091292; FAA/EE-80-26) Avail: NTIS HC A17/MF A01 CSCL 13/2

This document reports noise levels of a general aviation propeller aircraft noise test at the FAA National Aviation Facility Experimental Center located in Atlantic City, New Jersey. The test was performed to acquire noise data on general aviation type aircraft and examine how these noise levels are influenced by variables such as distance, aircraft speed, power settings, and propeller speeds. Aircraft were tested during takeoff, approach, and flyover modes and data are given in EPNL and in 'A'-weighted decibels. All measurements were performed in accordance with FAR 36 Appendix C and Appendix F procedures. GRA

N81-13718# Naval Research Lab., Washington, D. C.
CONTRIBUTION OF ANTISYMMETRIC AND SYMMETRIC WAVES TO THE REFLECTION OF SOUND IN A FLUID BY A THICK, HOMOGENEOUS PLATE
Pieter S. Dubbelday 23 Oct. 1980 15 p refs
(AD-A091233; NRL-MR-4312) Avail: NTIS HC A02/MF A01 CSCL 20/1

Thick-plate theory, for flexural and extensional waves in plates is applied to the analysis of the reflection of sound from an isotropic, homogeneous plate. An explicit expression is given for the reflection coefficient when both antisymmetric and symmetric waves are contributing to the reflection mechanism. This is compared with the case in which these types of waves are assumed to occur separately. It is shown that the relative strength of the two wave types, as measured by the cross-sectional average of the square of the particle displacement, is strongly dependent on coincidence between the trace speed of the incident wave in the fluid and the free wave speed of the pertinent wave type in the plate. Away from resonances, the energy densities of the two wave types appear to be about equal. This leads to the conclusion that the contribution of symmetric waves to the reflection of sound by a plate should be taken into account. GRA

N81-13719# Wyle Labs., Inc., El Segundo, Calif.
CORRECTION PROCEDURES FOR AIRCRAFT NOISE DATA. VOLUME 3: FILTER EFFECTS Final Report
Louis C. Sutherland Jul. 1980 93 p refs
(Contract DOT-FA78WA-4143)
(AD-A091016; WR-79-9-Vol-3; FAA-EE-80-1-Vol-3) Avail: NTIS HC A05/MF A01 CSCL 20/1

A method has been developed to quantify errors in measurement, correction and extrapolation of aircraft noise data which are attributable to spectrum slope and nonideal filter transmission characteristics. The method's fundamental basis is an iterative calculation scheme which recovers an estimate of the true spectrum shape of a signal from its measured band levels. This 'true' spectrum can then be extrapolated to other distances or have frequency dependent corrections made to it on an exact basis without need for worry about filter or slope errors. The new spectrum may then be re-integrated to produce band levels suitable for input to EPNdB or PNL calculations. Applying this procedure to real flyover data and comparing the resultant values of EPNL with those using FAR Part 36 procedures showed only small differences usually. However, the technique provides a consistent method for the analysis of errors due to these sources and should be useful for estimating their magnitude in the future. GRA

N81-13720# Wyle Labs., Inc., El Segundo, Calif.
CORRECTION PROCEDURES FOR AIRCRAFT NOISE DATA. *VOLUME 5: PROPELLER AIRCRAFT NOISE Final Report*
David Brown and Louis C. Sutherland Jul. 1980 59 p refs
(Contract DOT-FA78WA-4143)
(AD-A091017; WR-79-9-Vol-5; FAA-EE-80-1-Vol-5) Avail: NTIS HC A04/MF A01 CSCL 20/1

This report examines three particular problem areas associated with the measurement of noise levels of propeller-driven small airplanes required to comply with FAR Part 36, Appendix F. These problems are directly related to effects of atmospheric conditions on (1) the performance capabilities of an airplane when tested at various barometric pressures and altitude densities; (2) the noise signature generated at such conditions; and (3) the propagation of sound from the airplane to the measuring station. The first two of these have been addressed by deriving potential correction procedures which could be applied to noise levels obtained by tests not in strict compliance with Appendix F. These corrections are based on aircraft operations conducted within a specific margin of power setting. The corresponding measured noise levels are subsequently corrected for variation of propeller tip speed, forward velocity and barometric pressure relative to predetermined reference conditions. The third effect, that of sound propagation, is examined by applying SAE ARP 866A to a typical propeller airplane noise spectrum and demonstrating the range of A-weight noise levels that would result within a range of ambient conditions. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N81-13721 Yale Univ., New Haven, Conn.
ATOMIC COLLISIONS: ELECTRON DETACHMENT AND

RESONANT INELASTIC SCATTERING Ph.D. Thesis
Piyush Chandra Jha 1980 166 p
Avail: Univ. Microfilms Order No. 8026431

Observation shows that the detachment cross section increases with energy in the adiabatic region below 2 keV in H(-) + He. The compound state model is not appropriate because a strong s-wave component in the wavefunction allows the extra electron to run away as soon as its state becomes unbound. The detachment cross section increases with the collision velocity because detachment is induced by a breakdown of the Born-Oppenheimer approximation which shifts to larger separations of the nuclei as the collision velocity increases. A method is proposed for calculating the positions of resonances and cross sections in electron molecule collisions by enclosing the entire system in a spherical box, thus converting the problem to a bound state problem. It is used to calculate the energies of resonances in collisions of slow electrons with Ne, Ar, Kr, and Xe. The problem is simplified by invoking the Grandparent Model (that the resonances consist of two loosely bound electrons outside a compact positive ion core). The model is tested by explaining the Schulz's Law. Cross sections for excitation of Ne and Ar atoms from the ground state to the lowest metastable and uv emitting levels are calculated. Dissert. Abstr.

N81-13722# International Atomic Energy Agency, Vienna (Austria).
INTERNATIONAL ATOMIC ENERGY AGENCY BULLETIN, VOLUME 22, NO. 5 AND 6
Oct. 1980 158 p refs
(ISSN-0020-6067) Avail: NTIS HC A08/MF A01

The assessment of benefits and risks associated with various energy sources and systems is considered in relation to human needs. Particular emphasis is given to occupational hazards connected with coal mining, the handling of natural and liquified petroleum gases, and the use of nuclear energy for electric power generation. A method of energy risk comparison is examined as well as the approach of a regulatory agency to the concept of risk. Reports of international conferences on the management of alpha contaminated waste and on plasma physics and controlled nuclear fusion research are included. A.R.H.

N81-13723# University of Western Ontario, London. Dept. of Chemistry.
PHOTOPHYSICAL BEHAVIOR OF POLYATOMIC MOLECULES Final Report, 1 Aug. 1972 - 31 Dec. 1979
William R. Ware Oct. 1980 69 p refs
(Grants DA-ARO (D)-31-124-72-G179; DAAG29-77-G-0048; DAAG29-76-G-0114)
(AD-A090791; ARO-10855.7-C; ARO-13329.13-C) Avail: NTIS HC A04/MF A01 CSCL 20/10

Part one of this report deals with attempts over the past several years to devise a more sophisticated theory of diffusion controlled reactions than that presented by Collins and Kimball. In particular, the investigators were interested in a more realistic formulation of the problem of high concentration quenching where quenches in the vicinity of the molecular to be quenched must be considered. It was desired however, to obtain a formalism which was tractable mathematically and which contained parameters which would be related to experiment. Part two deals with the photophysics of systems exhibiting molecular association both in the ground and excited states has been studied. The emphasis has been on kinetic models, the measurement of rate constants associated with these models, and the determination of activation parameters and equilibrium thermodynamic parameters associated with the exciplex formation and disappearance. Studies of solvent effects and steric effects on the behavior of exciplex systems have been carried out. The case of rapid equilibrium where the monomer and exciplex decay with the same rate constant has also been examined. GRA

N81-13724# Sandia Labs., Albuquerque, N. Mex. Experiments Planning Div.
PASSIVE NEUTRON DOSIMETRY ON CRUISE MISSILE TESTS
Ronald I. Ewing 1980 5 p refs
(SAND-80-0637C) Avail: NTIS HC A02/MF A01

In these tests, the neutron generator unit is enclosed inside a recoverable steel box (called a boom box) weighing about 4.5 kilograms of which about 10% is nickel. When the neutron generator is actuated, some of the neutrons produced at that time interact with the nickel in the boom box to produce radioactive cobalt by the fast neutron reaction Ni58(n,p) Co58. The Co58 decays with a half life of 70.8 days and produces an 811 keV gamma ray in 98% of the decays. The detection of this 811 keV gamma ray, which is not normally present in the environment, is taken as evidence that fast neutrons were produced in the test. J.M.S.

N81-13725# Fermi National Accelerator Lab., Batavia, Ill.
REVIEW OF RECENT MEASUREMENTS OF CHARMED PARTICLE LIFETIMES USING EMULSIONS
L. Voyvodic Dec. 1979 7 p refs Presented at 9th Intern. Symp. on Lepton and Photon Interactions at High Energy, Batavia, Ill., 23 Aug. 1979
(Contract DE-AC02-76CH-03000)
(FERMILAB-CONF-79/80-Exp; CONF-790885-19) Avail: NTIS HC A02/MF A01

Results on charmed particle decays in emulsions are presented and include two sets of associated D bar D candidates from proton collisions, a bar D(0) event from photon collisions, and 17 analyzable neutrino-induced charm candidates. DOE

N81-13726# Fermi National Accelerator Lab., Batavia, Ill.
RECENT EXPERIMENTAL MEASUREMENTS OF THE NEUTRINO CHARGED CURRENT CROSS SECTIONS
D. Theriot 1979 7 p refs Presented at the 9th Intern. Symp. on Lepton and Photon Interactions at High Energy, Batavia, Ill., 23 Aug. 1979
(Contract DE-AC02-76CH-03000)
(FERMILAB-CONF-79/79-Exp; CONF-790885-18) Avail: NTIS HC A02/MF A01

The formalism and experimental measurements of neutrino charged current total cross sections are reviewed. Measurement apparatus is discussed in some detail. Data is well represented for neutrino energies above 20 GeV. DOE

N81-13727# Sandia Labs., Albuquerque, N. Mex. Generator Development Div.
PULSED NEUTRON GENERATOR FOR USE WITH PULSED NEUTRON ACTIVATION TECHNIQUES
Gary E. Rochau 1980 14 p refs Presented at the 8th Water Reactor Safety Res. Inform. Meeting, Gaithersburg, Md., 27 Oct. 1980
(Contract DE-AC04-76DP-00789)
(SAND-80-1902C; CONF-801053-1) Avail: NTIS HC A02/MF A01

A high output, transportable, pulsed neutron generator was developed for use with pulsed neutron activation techniques. The generator is designed to be easily repaired and modified. The unit requires no additional equipment for operation or measurement of output. DOE

N81-13728# California Univ., Livermore. Lawrence Livermore Lab.
USE OF MOLECULAR BEAMS TO SUPPORT MICROSPHERES DURING PLASMA COATING
J. K. Crane, R. D. Smith, W. L. Johnson, S. A. Letts, G. R. Korbel, and R. M. Krenick Aug. 1980 23 p refs Presented at the Am. Vacuum Soc. Conf., Detroit, 14-17 Oct. 1980
(Contract W-7405-eng-48)
(UCRL-84488; CONF-801037-9) Avail: NTIS HC A02/MF A01

Molecular beam levitation for supporting microspheres during plasma coating or plasma etching are discussed. The reliability of this technique is principally the result of two things: the success of a special centering device which provides a lateral, stabilizing force on the levitated microspheres and a gas handling system which is capable of controlling levitation gas flow in the microtorr liter/sec. range. It is determined that the operational regime of this device is that of Knudsen's flow. DOE

N81-13729 Florida Univ., Gainesville.
THEORY OF IONIZING ATOMIC COLLISIONS AT THERMAL ENERGIES Ph.D. Thesis
Lawrence Ralph Relyea 1980 184 p

Avail: Univ. Microfilms Order No. 8029084

Ionization in low-energy atomic collisions involving electronically excited species is investigated using coupled channels and effective Hamiltonian theories for the heavy particle motion. Within the coupled channels formulation detailed electron energy distributions are obtained for the Penning ionization of Ar by He(ls2s,3S); the structure is interpreted as arising from final channel heavy particle resonances, and this interpretation provides new insight into the role of the nuclear dynamics on electron emission. The Riccati transform of the matrix Schroedinger equation arising in the coupled channels theory is solved to obtain cross sections for Penning ionization over a range of energies, and results were found to compare well with experiment. An effective Hamiltonian theory for Penning and associative ionization is formulated using projection operator techniques; an effective potential is obtained for the nuclear motion of a discrete electronic state which is unstable with respect to decay by electron emission. Analysis of a complex, non-local and energy-dependent potential energy kernel demonstrates for the first time that, while a local approximation to the real part may be valid, such approximation may not be valid for the imaginary part. Dissert. Abstr.

N81-13730 Pennsylvania Univ., Philadelphia.
GIANT RAMAN SCATTERING BY MOLECULES ADSORBED AT METAL ISLAND FILMS Ph.D. Thesis
Cheng Yueh Chen 1980 164 p
Avail: Univ. Microfilms Order No. 8028846

In order to elucidate the role of submicroscopic surface roughness and, in particular, the role played by the collective electron resonance (e.g., localized plasmons) of the short range structures of rough metal surface, the Raman scattering (RS) by molecules adsorbed on metal island films was investigated. The RS by molecules absorbed on a Ag island film is comparable in intensity and similar in character to that of pyridine adsorbed on an electrochemically processed Ag electrode. The major enhancement is in fact due to the increase in the effective electric field at the sites of the adsorbed molecules when collective electron resonances are excited by the incident EM radiation and to the large electric dipole moments for scattered radiation that are induced in the metal islands by the coulomb fields of the electric dipoles of the Raman excited molecules. The metal islands act effectively as resonant amplifiers for both incident and scattered radiation in the enhanced Raman process. The similarities in behavior of an Ag island film and a randomly roughened metal surface (e.g., Ag electrode) in the enhanced RS process are discussed. Dissert. Abstr.

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N81-13731# Naval Research Lab., Washington, D. C. Experimental Plasma Physics Branch.
INTENSE PULSED ION BEANS: THEIR GENERATION AND APPLICATIONS Interim Report
J. Golden, C. A. Kapetanakos, J. A. Pasour, and R. A. Mahaffey 3 Oct. 1980 67 p refs
(AD-A090593; NRL-MR-4290) Avail: NTIS HC A04/MF A01 CSCL 20/7

The fundamentals of intense pulsed ion beam generation are reviewed. The basic processes operating in reflexing electron sources, pinched electron diodes, and magnetically insulated diodes are described. Some selected applications are surveyed; included are gas laser excitation, inertial confinement fusion, field reversed ion rings, and ion acceleration by magnetic compression. GRA

N81-13732# Sandia Labs., Albuquerque, N. Mex. Theoretical Div.
CALCULATION OF THE RESPONSE OF CYLINDRICAL TARGETS TO COLLIMATED BEAMS OF PARTICLES USING ONE-DIMENSIONAL ADJOINT TRANSPORT TECHNIQUES
Stephen A. Dupree Jun. 1980 20 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-0432) Avail: NTIS HC A02/MF A01

The use of adjoint techniques to determine the interaction of externally incident collimated beams of particles with cylindrical targets is a convenient means of examining a class of problems important in radiation transport studies. The theory relevant to such applications is derived, and a simple example involving a fissioning target is discussed. Results from both discrete ordinates and Monte Carlo transport code calculations are presented, and comparisons are made with results obtained from forward calculations. The accuracy of the discrete ordinates adjoint results depends on the order of angular quadrature used in the calculation. Reasonable accuracy by using EQN quadratures can be expected from order Sub 16 or higher. DOE

N81-13733# Maryland Univ., College Park. Computer Science Center.
ELECTRON BEAM EXPERIMENTS AT MARYLAND UNIVERSITY
M. A. Brennan, P. Loschialdo, W. Namkung, M. Reiser, and J. D. Lawson (Rutherford Lab.) 1979 8 p refs Presented at the 1979 HIF Workshop, Berkeley, Calif., Nov. 1979 Sponsored in part by DOE
(CONF-7910122-13) Avail: NTIS HC A02/MF A01

The stability of intense electron beams in long periodic focusing systems was studied. The components of the system are described in detail. R.C.T.

N81-13734# Rockwell International Corp., Richland, Wash. Systems Engineering Dept.
HEAT TRANSFER ANALYSIS OF THE GEOLOGIC DISPOSAL OF SPENT FUEL AND HIGH LEVEL WASTE STORAGE CANISTERS
G. K. Allen Aug. 1980 47 p refs Presented at the Am. Soc. of Mech. Engrs. Winter Ann. Meeting, Chicago, 16-21 Nov. 1980
(Contract DE-AC06-77RL-01030)
(RHO-SA-160; CONF-801102-28) Avail: NTIS HC A03/MF A01

Near-field temperatures resulting from the storage of high-level waste canisters and spent unreprocessed fuel assembly canisters in geologic formations were determined. Preliminary design of the repository was modeled for a heat transfer computer code, HEATING5, which used the finite difference method to evaluate transient heat transfer. The heat transfer system was evaluated with several two and three dimensional models which transfer heat by a combination of conduction, natural convention, and radiation. Physical properties of the materials in the model were based upon experimental values for the various geologic formations. The effects of canister spacing, fuel age, and use of an overpack were studied for the analysis of the spent fuel canisters; salt, granite, and basalt were considered as the storage media. The effects of canister diameter and use of an overpack were studied for the analysis of the high-level waste canisters; salt was considered as the only storage media for high-level waste canisters. DOE

N81-13735# California Univ., Livermore. Lawrence Livermore Lab.
PULSING A CHARGED PARTICLE BEAM BY ENERGY MODULATION AND DISPERSIVE DEFLECTION
V. K. Neil and A. C. Paul (California Univ., Berkeley, Lawrence Berkeley Lab.) 17 Sep. 1980 29 p refs
(Contracts W-7405-eng-48; N60921-80-WR-W0188)
(UCID-18774) Avail: NTIS HC A03/MF A01

A method for the production of a variable duty cycle pulsed electron beam is investigated theoretically. A longitudinally uniform beam is passed through a radio frequency cavity that introduces energy modulation of the beam particles. The beam then enters a magnetic deflection array with dispersive properties that allow transmission of particles with momentum within a range selected by the position of a beam stop within the array. The transmitted portion of the beam exits the array along the same beam line with no angular or positional dispersion. DOE

N81-13736# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho. Waste Management Program.
DEVELOPMENT OF CRITERIA AND STANDARDS FOR MANAGEMENT OF LOW-LEVEL RADIOACTIVE WASTE
A. E. Grey and K. L. Falconer Aug. 1980 37 p
(Contract DE-AC07-76ID-01570)
(EGG-WM-5233; PR-W-80-21) Avail: NTIS HC A03/MF A01

The nature of low-level radioactive waste and the role government agencies play in regulating its management are discussed in view of criteria and standards development. Subject areas for which criteria and standards could be developed, current and evolving requirements, and future suggested analyses are examined. DOE

N81-13737# Sandia Labs., Albuquerque, N. Mex. Applied Technology Div.
INTENSE NEUTRON SOURCE: HIGH-VOLTAGE POWER SUPPLY SPECIFICATIONS
Alfred A. Riedel Aug. 1980 12 p
(Grant NCI CA-25156)
(SAND-80-1911) Avail: NTIS HC A02/MF A01

Electrical, mechanical and safety specifications for high voltage power supply to be used with the intense neutron source are detailed. Sufficient information for a supplier to bid on such a power supply is included. Author

N81-13738# Rensselaer Polytechnic Inst., Troy, N. Y. Plasma Dynamics Lab.
PLASMA DIAGNOSTIC TECHNIQUES USING PARTICLE BEAM PROBES
William C. Jennings Jul. 1980 56 p refs Presented at the 1980 Mini-Course on Mod. Plasma Diagnostics, Madison, Wisc., May
(Contract DE-AS02-76ET-53004)
(DOE/ET-53004/3; RPDL-80-15) Avail: NTIS HC A04/MF A01

Particle beam probing is discussed. Techniques which involve the injection of a beam of neutral particles into the plasma are considered. The techniques of beam attenuation, beam scattering, and active charge exchange using a beam of light particles such as hydrogen or helium are presented. Optical measurements of the Zeeman splitting of the radiation from a neutral lithium beam is discussed, including a new proposal for significantly improving this technique through the addition of a dye laser. Two techniques involving the injection of heavy neutral particles are presented, as well as two proposed techniques for measuring the properties of the alpha particles produced from actual fusion reactions. The diagnostic techniques which are based upon the injection of a beam of charged particles into the plasma are described. DOE

74 OPTICS

Includes light phenomena.

N81-13739*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SPATIAL FREQUENCY RESPONSE OF AN OPTICAL HETERODYNE RECEIVER
Don M. Robinson and Carl L. Fales Dec. 1980 24 p refs
(NASA-TP-1763; L-14099) Avail: NTIS HC A02/MF A01 CSCL 20F

The analysis of a passive heterodyne receiver with respect to its imaging performance (transfer function) and its heterodyne efficiency shows departures from the results which are obtained in strictly coherent or incoherent imaging systems. The cascading property of modulation transfer function analysis must be carefully applied, since the coherent transfer function of the optical receiver and that due to the local oscillator-detector combination are not separable but are related by the convolution of their products. Application of these results to a spacelab-type optical heterodyne receiver shows that resolutions of the order of 1.5 to 2.0 km are possible for worst-case type orbital scenarios. In addition to an analysis of the derogatory effects of sampling (aliasing) a comparison of obscured-type receivers (e.g., Cassegrains) with unobscured receivers shows that both resolution and efficiency are severly degraded in an obscured-type receiver and, consequently, should not be used for passive heterodyne detection schemes. Author

N81-13740# Hughes Research Labs., Malibu, Calif.
INFRARED FIBER OPTICS Final Technical Report, 14 Apr. 1978 - 12 Apr. 1980
James A. Harrington, Roger R. Turk, D. M. Henderson, and Arlie Standlee Sep. 1980 85 p refs
(Contract F19628-78-C-0109; AF Proj. 2306)
(AD-A091321; RADC-TR-80-290) Avail: NTIS HC A05/MF A01 CSCL 20/6

This final report summarizes a two-year research program to fabricate optical fibers that are transmissive between 1 and 12 microns. The ultimate goal of this program is to prepare infrared (IR) transmitting fibers with losses less than 5 dB/km. In preparing IR fibers with these low losses, we emphasized the extrusion of very pure KCl as this material has demonstrated bulk losses equal to or less than 5 dB/km in the 2 to 6 micron region. Unfortunately, we were not able to extrude bulk KCl into fiber with losses even approaching the goal. During the two-year program, we improved our KCl fiber from an initial loss of 20,000 dB/km to a best value of 4,200 dB/km. The exceptionally high losses in extruded KCl fiber resulted from the poor surface quality of the fiber. During the extrusion process, the friction between the die and fiber resulted in fibers whose surfaces were highly irregular (fish-scale appearance). Although lubricants alleviated this problem, we found that the fibers still had poor transmission because the lubricants (polymers, in general) could not be completely removed. Extrusions (without lubricants) using different die materials, die shapes, temperatures (25 to 30 C), and extrusion rates (1 mm/hr to 1 cm/sec) did not improve the overall quality of the fiber's suface. GRA

N81-13741# Los Alamos Scientific Lab., N. Mex.
LONG WAVELENGTH SCINTILLATORS FOR FIBER-OPTIC APPLICATIONS
P. B. Lyons, L. Franks, S. Lutz, J. Flournoy, and E. Fullman 1980 5 p refs Presented at the IEEE Nucl. Sci. Symp., Orlando, Fla., 5 Nov. 1980 Prepared in cooperation with Edgerton, Germeshausen and Grier, Inc., Santa Barbara, Calif.
(Contract W-7405-eng-36)
(LA-UR-80-1906; CONF-801103-3) Avail: NTIS HC A02/MF A01

The use of fiber optics in plasma diagnostics spurred the development of long wavelength scintillators, with fast temporal characteristics. Several new liquid scintillator systems with fluorescent emissions are described. Subnanosecond scintillator response times were obtained by the operation of liquid scintillators at elevated temperatures. Data on fiber system sensitivity versus fiber length and scintillator emission wavelength are presented. DOE

N81-13742# California Univ., Livermore. Lawrence Livermore Lab.
OPTICAL ALIGNMENT DEVICE FOR ALIGNING AN EXTERNAL LASER TO AN ARBITRARY AXIS
J. E. Murray and W. A. Jones Jun. 1980 19 p ref
(Contract W-7405-eng-48)
(UCID-18791) Avail: NTIS HC A02/MF A01

An alignment device to simplify the alignment of an external laser to an arbitrary axis was constructed. It provides independent adjustments for the four required beam motions: two orthogonal translations and two orthogonal rotations about an external point. DOE

N81-13743# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
OPTICAL C SUB n2 INSTRUMENT MODEL 2
G. R. Ochs, W. D. Cartwright, and D. D. Russell Dec. 1979 29 p refs
(PB80-209000; NOAA-TM-ERL-WPL-51; NOAA-80061115)
Avail: NTIS HC A03/MF A01 CSCL 20F

An optical instrument that measures the path averaged value of the refractive-index structure parameter (C sub n, sup 2) over optical paths from 100 to 500 meters is described. Using an optimum path length of 300 to 400 meters, C sub n, sup 2

can be measured over a range from 1 x 10 to the -12 power to 1 x 10 to the -16 power/(m to the 2/3 power). GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N81-13744 Illinois Univ. at Urbana-Champaign.
ION BUNCHING AT HIGH ENERGIES Ph.D. Thesis
Gary Burton Johnson 1980 89 p
Avail: Univ. Microfilms Order No. 8026531

The electrostatic space charge fields produced by a reflex triode can be used to extract, accelerate, focus and bunchions onto a target. A Nereus e-beam accelerator used to drive the reflex triode produced 35 ns electron beam pulse of 300 kV and 50 kA. Ions in an electrostatic space charge well on the far side of the transparent anode were accelerated downstream and due to the distribution in their velocities, a bunching of their arrival times at a point downstream occurred. Negatively biased Faraday cup probes were used to measure the intensity, pulse width, and time-of-flight of the ion beam downstream. Time-of-flight data indicate that the ions are being accelerated to < 90% of the applied anode potential. Ion beam current densities of up to 160 A/sq cm were obtained yielding electron beam to ion beam conversion efficiencies of > 25%, and bunching factors of greater than four have been observed. The feasibility of using efficient electron beam machines to produce intense high energy ion beams as the driver for pellet fusion is considered. Dissert. Abstr.

N81-13745 Rochester Univ., N. Y.
THE INTERPRETATION OF CHARGED PARTICLE MEASUREMENTS ON LASER PRODUCED PLASMAS Ph.D. Thesis
Bryan William Nicholson 1980 91 p
Avail: Univ. Microfilms Order No. 8028919

The ion current of an expanding laser produced plasma depends on both the ion charge state and the ion flux. It is shown that these are independent parameters of the plasma. The former is determined by recombination late in the plasma expansion. The latter reflects the target's dynamics early in time due to energy absorption and transport. Measurements show that the plasma's asymptotic charge state as a function of velocity is insensitive to changes in the incident energy. Numerical simulation confirms that the observed charge states are essentially independent of the target dynamics. The ion flux, on the other hand, is sensitive to variations in the modeling of both the energy absorption and transport. In particular the observed two peaked structure of the ion current depends on the amount of energy absorbed and the partitioning of that energy between thermal particles and non-thermal long range electrons. The shape of the valley between the two peaks depends on the flux limited thermal conductivity in the absorption region. Dissert. Abstr.

N81-13746 Illinois Univ. at Urbana-Champaign.
FUSION-PRODUCT TRANSIORT IN AXISYMMETRIC TOKAMAKS: LOSSES AND THERMALIZATION Ph.D. Thesis
Lee Mizener Hively 1980 210 p
Avail: Univ. Microfilms Order No. 8026521

Prompt escape loss fluxes were calculated including the nonseparable dependence of flux as a function of poloidal angle and local angle of incidence at the first wall. The flux was strongly peaked at near grazing incidence, suggesting that blistering injected impurities can reduce reactor burn times by 50-70%. Nonprompt losses were also calculated and make a small contribution to impurity production. Sensitivity studies show the plasma wall separation to be the strongest factor controlling prompt losses. Modest increases in wall radius (plasma radius fixed) of a device, such as the ORNL-EPR, were found to reduce blistering injected impurities to a level which should no longer limit the burn time. Fusion product (p) thermalization and heating was calculated assuming classical slowing down. An analytical model is presented that describes fast ion orbits and their distribution function to realistic high beta, noncircular Tokamak equilibria. Dissert. Abstr.

N81-13747 Illinois Univ. at Urbana-Champaign.
THEORETICAL STUDY ON MAGNETIC SHIELDING OF AN ABLATING SOLID HYDROGEN PELLET IN A PLASMA AND HYDROGEN PELLET PRODUCTION AND INJECTION INTO THE APEX TOKAMAK Ph.D. Thesis
Richard Phillip Gilliard 1980 114 p
Avail: Univ. Microfilms Order No. 8026499

The problem of magnetic diffusion into an ablation cloud and the corresponding effect on ablation rates is solved rigorously. Accurate criteria are developed for assessing the significance of magnetic shielding for various pellet and plasma configurations, and more generalized equations and scaling laws are presented which govern the ablation process in the case of partial shielding. In addition, a solid pellet injector was developed which produces relatively large solid pellets (diameters in the range of 400 to 900 micron m) and accelerates them to speeds higher than 10 to the 4th power cn/sec. In addition, the device is capable of continuous pellet production at an adjustable rate ranging from roughly a hundred to several thousand per second. The results of injection into the APEX Tokamak at Argonne National Laboratory are presented, and the validity of the newly developed scaling laws is evaluated in light of existing experimental data. Dissert. Abstr.

N81-13748# Naval Research Lab., Washington, D. C.
PROPAGATION OF RELATIVISTIC ELECTRON BEAMS IN CURRENT CARRYING PLASMA CHANNELS Interim Report
D. P. Bacon (Dartmouth College, Hanover, N.H.), G. Cooperstein, I. M. Vitkovitsky, and S. A. Goldstein (JAYCOR, Inc., Alexandria, Va.) 5 Sep. 1980 29 p refs
(AD-A090931; NRL-MR-4330) Avail: NTIS HC A03/MF A01 CSCL 20/8

Experimental results of propagating up to 400 kA of relativistic electron beams (approx. 1 MeV) over a distance of 64 cm in a tightly focused mode are reported. Efficient transport (greater than 80%) was observed when a channel of plasma containing enough current to confine the hot electrons was used. Theory of the flow includes return current effects, and is in good agreement with experimental results. The theory is used to predict limits of this technique. GRA

N81-13749# Georgia Inst. of Tech., Atlanta. School of Physics.
THE DRIFT, DIFFUSION, AND REACTIONS OF SLOW IONS IN GASES Final Report, 1 Jul. 1975 - 28 Feb. 1980
E. W. McDaniel and I. R. Gatland 28 Feb. 1980 7 p refs
(Contract N00014-76-C-0015)
(AD-A090951) Avail: NTIS HC A02/MF A01 CSCL 07/4

The Georgia Tech program of research on ionic transport in gases is described. Experimental measurements of ionic mobilities and diffusion coefficients are discussed. The use of mobility data to obtain ion-neutral interaction potentials is described. References are given for publications covering this report period. GRA

N81-13750# Los Alamos Scientific Lab., N. Mex.
APPLICATION OF INTENSE RELATIVISTIC ELECTRON BEAMS TO HEATING AND CONFINEMENT OF TOROIDAL PLASMA EXPERIMENTS
Carl A. Ekdahl Aug. 1980 10 p refs
(Contract W-7405-eng-36)
(LA-8496-MS) Avail: NTIS HC A02/MF A01

The use of intense relativistic electron beams for heating toroidal plasmas applied to toroidal z-pinch experiments (ZT-40 and ZT-S) is examined. The conclusion is reached that a modestly sized beam (approximately k$150) could be useful for heating an experiment with the size of ZT-S, but that it would require a much larger beam to significantly effect the bulk temperature of larger experiments, such as ZT-40. DOE

N81-13751# California Univ., Livermore. Lawrence Livermore Lab.
MICROWAVE HEATING OF HOT, OVERDENSE PLASMAS
Kenneth R. Eppley 4 Dec. 1979 24 p refs
(Contract W-7405-eng-48)

(UCID-18486) Avail: NTIS HC A02/MF A01

Calculations made of the heating of hot (5 keV), overdense (10 to the 8th power critical density) deuterium plasmas by 1 cm microwaves with an incident power of 5 x 10 to the 16th watts/sq cm are discussed. Dependence of the heating rate on the plasma temperature and the drift velocity of the surface is also studied. The power absorption is found to vary approximately as T(1/2). DOE

N81-13752# California Univ., Berkeley. Lawrence Berkeley Lab.
MHD PLASMA STABILITY IN HIGH MIRROR RATIO OPEN TRAPS
D. D. Ryutov and G. V. Stupakov 29 Jul. 1980 25 p refs Transl. of Russian Journal Preprint 8-130
(UCRL-Trans-11614) Avail: NTIS HC A02/MF A01

On the basis of graphic considerations, the perturbation of plasma magnetic energy is estimated and the conditions under which a high mirror ratio actually leads to a decrease in beta/sub crit/ are found. With allowance for these results, a formal minimization of the system's total potential energy is made and the equation for the eigenfunctions of the most dangerous perturbations is found. This equation is solved and simple analytic formulas are derived for beta/sub crit/. DOE

N81-13753# Texas Univ. at Austin. Fusion Research Center.
TOKAMAK CURRENT DRIVEN BY ELECTROMAGNETIC WAVES
S. M. Mahajan and D. A. Hitchcock Aug. 1980 10 p refs (Contract DE-AC05-76ET-53036)
(DOE/ET-53036/20; FRCR-215) Avail: NTIS HC A02/MF A01

An expression for quasilinear diffusion in an electromagnetic field is derived, and based on that, a new scheme for current drive which utilizes the motion of electrons in a purely transverse electromagnetic field is proposed and discussed. DOE

N81-13754# Princeton Univ., N. J. Plasma Physics Lab.
TOROIDAL EFFECTS ON PROPAGATION, DAMPING, AND LINEAR MODEL CONVERSION OF LOWER HYBRID WAVES
D. W. Ignat Sep. 1980 19 p refs
(Contract DE-AM02-76CH-03073)
(PPPL-1701) Avail: NTIS HC A02/MF A01

A common simplifying assumption made in the consideration of radio frequency heating of Tokamaks near the lower hybrid frequency is that the wave length imposed by the coupling device parallel to the magnetic field is not modified by gradients along the field. In the present calculation, the parallel wavelength is allowed to vary, and important effects are found on wave penetration and damping if the toroidal aspect ratio is less than approximately 5. DOE

N81-13755# Princeton Univ., N. J. Plasma Physics Lab.
STARK BROADENING OF ISOLATED LINES FROM HIGH-Z EMITTERS IN DENSE PLASMAS
J. C. Weisheit and E. L. Pollock (Calif. Univ., Livermore. Lawrence Livermore Lab.) Sep. 1980 18 p refs Presented at the 5th Intern. Conf. on Spectral Line Shapes, Berlin, 7 Jul. 1980 Prepared in cooperation with Lawrence Livermore Lab., Calif.
(Contract DE-AM02-76CH-03073; W-7405-eng-48)
(PPPL-1686; CONF-800768-1) Avail: NTIS HC A02/MF A01

The joint distribution of the electric microfield and its longitudinal derivative is required for the calculation of line profiles for the He-like ions in very dense plasmas. A molecular dynamics code was used to compute exact distributions in single- and multi-component plasmas, and analytical approximations to these results were investigated. A simplified, two-nearest-neighbor scheme was found that leads to surprisingly accurate distribution functions. DOE

N81-13756# Northwestern Univ., Evanston, Ill.
COMPUTER SIMULATION OF KINETIC PROPERTIES OF PLASMAS Progress Report, 1 Jul. 1979 - 30 Jun. 1980
J. Denavit 1980 9 p refs
(Contracts DE-AC02-76ET-53041; EY-76-S-02-2200)
(DOE/ET-53041/12) Avail: NTIS HC A02/MF A01

The development and testing of numerical methods for particle and hybrid simulation of plasmas, and their application to physical problems of significance to magnetic fusion energy are addressed. The radial dependence and shear stabilization of drift and dissipative trapped electron instabilities; long-time-scale algorithms for particle simulation with omega sub pe delta t much greater than 1, and computer studies of field-reversed ion rings are disussed. DOE

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N81-13757 Lowell Univ., Mass.
CALCULATIONS OF THE VIBRATIONAL DENSITY OF STATES OF AMORPHOUS GERMANIUM AND SILICON Ph.D. Thesis
Robert Francis Nutter 1980 205 p
Avail: Univ. Microfilms Order No. 8028390

The standard methods for calculation of the vibrational properties of a crystalline medium break down in the amorphous case because they depend on the simplifications resulting from the long range crystal order. Many attempts have been made to either adapt the crystalline methods to the amorphous case or to develop new approaches. To date, none have proven satisfactory, although measurements of various properties of the amorphous materials germanium and silicon suggest behavior significantly similar to that of the crystal. The relative successes and failures of previous calculational methods were examined and an approach was designed to take advantage of the apparent fact that the density of vibrational states must depend strongly on fairly local correlations in order for gross features to persist into the amorphous experimental measurements. It proved possible to produce the fundamental features of the amorphous vibrational spectrum and to shed light on the results of prior calculations. Dissert. Abstr.

N81-13758 Illinois Univ. at Urbana-Champaign.
SURFACE ENHANCED RAMAN SCATTERING STUDIES IN ULTRAHIGH VACUUM Ph.D. Thesis
Thomas Huntington Wood 1980 124 p
Avail: Univ. Microfilms Order No. 8026621

Raman scattering signals from carbon monoxide adsorbed on silver films deposited on a 120 K substrate are approximately 5 orders of magnitude stronger than would be expected from the known cross section. This enhancement is similar to that observed off silver electrodes in electrochemical cells. The enhancement is destroyed by room temperature annealing of the films, so the surface roughness inherent in the evaporation process is essential to the enhancement mechanism. Enhanced Raman scattering from CO adsorbed on evaporated gold films was observed, although the enhancement is approximately 300 times weaker than it is for silver. Dissert. Abstr.

N81-13759 Illinois Univ. at Urbana-Champaign.
EXCITONIC PHASES IN STRESSED, ULTRA-PURE SILICON Ph.D. Thesis
Paul Lee Gourley 1980 227 p
Avail: Univ. Microfilms Order No. 8026503

A fairly comprehensive set of photoluminescence measurements of the excitonic phases occuring in stressed, ultra-pure silicon at liquid helium temperatures is presented. The majority of the experiments were performed with a special stressing technique which created a Hertzian stress distribution to confine the photo-excited electron-hole pairs to a high stress region in the bulk of the crystal. Some unique experimental advantages of this method were realized in the examination of the electron-hole liquid (EHL) and excitonic complexes: (1) properties of the EHL from zero stress far into the high stress limit; (2) initial observations of excitonic molecules in a group IV material; (3) chemical equilibrium and kinetics of the excitonic gas phase (free excitons, excitonic molecules, bound excitons and free carriers); (4) metal isulator transition in stressed Si. Dissert. Abstr.

N81-13760 Illinois Univ. at Urbana-Champaign.
THE ATTENUATION OF LATTICE VIBRATIONS BY OSCILLATIONS OF INDEPENDENT AND COUPLED DISLOCATIONS Ph.D. Thesis
Gary Alan Kneezel 1980 213 p
Avail: Univ. Microfilms Order No. 8026539

The attenuation of a periodic stress wave by independent and coupled vibrating dislocations is considered with particular reference to two apparently unrelated phenomena: the effect of plastic deformation on the low temperature thermal conductivity of alkali halides, and the change in sound velocity and attenuation measured ultrasonically immediately prior to the fcc-hcp martensitic transformation in cobalt nickel. The results are not sufficiently detailed to provide conclusive evidence for the proposed model of extended dislocations widening as the transformation is approached. However, it is demonstrated by thermal conductivity calculations that the effect of a large density of vibrating coupled dislocations is larger than that of a larger density vibrating coupled dislocations is larger than that of independent dislocations at high frequencies. Dissert. Abstr.

N81-13761 California Univ., Davis.
OPTICAL AND ELECTRON TRANSPORT PROPERTIES OF REACTIVELY SPUTTERED Cu SUB x S Ph.D. Thesis
John Yick-Chung Leong 1980 195 p
Avail: Univ. Microfilms Order No. 8027068

Thin films of Cu(x)S were deposited on glass slides by sputtering Cu in a reactive H2S/Ar environment. Optical transmittance and reflectance measurements were used to explore the infrared absorption spectra of the material. Analysis of the absorption edge characteristics resulted in the identification of an indirect bandgap, a direct bandgap, and an electron effective mass. Electrical data consisting of resistivity and Hall effect measurements from liquid nitrogen to room temperatures were analyzed to determine the dominant scattering mechanisms limiting the hole mobility in the material. Ionized impurity scattering was the dominant mechanism at low temperatures ($T < 100$ K) and polar optical phonon scattering was most effective at high temperatures ($T > 150$ K). All films were p-type. The properties of the Cu(x)S films can be controlled by varying the pressure of the sputtering gas. Effects of temperature on the band structure of Cu(x)S were studied by measuring the optical transmittance at temperatures between 80 K and 300 K. Both the direct and indirect gaps decreased with temperature. Dissert. Abstr.

N81-13762 Princeton Univ., N. J.
ELECTRONIC EXCITATION SPECTRA IN A MODEL OF A DISORDERED SOLID POSSESSING LATTICE VIBRATIONS Ph.D. Thesis
Douglas Alan Bernard 1980 153 p
Avail: Univ. Microfilms Order No. 8028659

The changes in the electronic excitation spectrum of an amorphous solid due to coupling with lattice vibrations are examined. Using a model hamiltonian in which a single disordered band of electrons and a set of local oscillators are coupled at short range the lowest-order many-body effects of the retarded electron-electron interaction are considered. The effects of disorder are treated phenomenologically. As a consequence of static lattice relaxation and localization, a gap is found in the spectrum when the Fermi energy lies in a band tail. Additional features arising from the dynamic component of the interaction are discussed and computed for a range of coupling constants, phonon energies, and bare electronic models. Dissert. Abstr.

N81-13763 Oklahoma State Univ., Stillwater.
A STUDY OF THERMALLY STIMULATED LUMINESCENCE IN SYNTHETIC QUARTZ (IN THE REGION 96 K - 273 K) Ph.D. Thesis
Dost Muhammad Malik 1980 88 p
Avail: Univ. Microfilms Order No. 8027195

Thermoluminescence (TSL) was monitored in swept and unswept high quality synthetic quartz by irradiating at 96 K with a high energy (1.5 MeV) electron beam and recording the luminescence output as the temperature was increased from that temperature to 273 K. Simultaneously a spectral analysis was carried out on the TSL peaks. The experiment was carried out to identify the defects and recombination mechanisms responsible for TSL and to estimate the temperature at which irradiation induced mobility of alkaline impurities can be initiated. Low temperature (96 K) irradiation produces a TSL peak around 125 K (region 1), three overlapping peaks around 155 K, 165 K and 175 K (region 2) and two overlapping peaks around 210 K and 225 K (region 3) in unswept specimens. Only regions 1 and 2 are present in the swept specimens. Irradiation at 300 K preceding low temperature irradiation almost eliminates region 3 and slightly reduces region 2 in unswept specimens while having little effect on swept specimens. The emission wavelength is around 450 nm in region 1 and around 380 nm in regions 2 and 3. Dissert. Abstr.

N81-13764 Oklahoma State Univ., Stillwater.
LOW-TEMPERATURE THERMAL CONDUCTIVITY OF IRRADIATED AND SWEPT SYNTHETIC QUARTZ Ph.D. Thesis
Mohammad-Reza Jalilian-Nosraty 1980 76 p
Avail: Univ. Microfilms Order No. 8027190

The measurement of the thermal conductivities of three different synthetic quartz samples is discussed. Thermal conductivity measurements were taken for two samples, electronic grade sample (EG-S) and premium Q sample (PQ-S) on the range of 4.5 to 140 K. Premium Q sample, PQ-E11 was run over the 1.6 to 48 K range of temperature. Two sample holder systems were used. The effects of radiation damage at room temperature and of electrolyzing in the presence of hydrogen were studied. The shape of the thermal conductivity versus temperature curves was characteristic for single crystal insulating materials. Irradiation of samples EG-S and PQ-S at room temperature did not cause significant differences with the thermal conductivity of as-received samples. For sample PQ-E11 a dip centered near 5 K was introduced into its thermal conductivity after it was irradiated at room temperature. The result suggested a resonant phonon scattering caused by either the Al-OH or the (Al sub e+)(0) centers. In order to determine which, sample PQ-E11 was electrolyzed in hydrogen. Results indicate that the Al-OH center is the most likely cause of the resonant scattering.
Dissert. Abstr.

N81-13765 Oklahoma State Univ., Stillwater.
RADIATION EFFECTS IN QUARTZ RESONATORS Ph.D. Thesis
Stephen Paul Doherty 1980 109 p
Avail: Univ. Microfilms Order No. 8027175

The effects of irradiation and sweeping were examined on the Q and resonant frequency of 5 MHz 5th overtone AT-cut quartz resonator blanks. Acoustic loss measurements were made on swept und unswept resonators. The effects of variable temperature irradiation on sodium, hydrogen, and deuterium swept resonators were also investigated. Direct sweeping of quartz resonator blanks was successfully demonstrated and used to sweep sodium, hydrogen, and deuterium into four resonators. Quality control criteria and procedures for the preselection of radiation-hard quartz were developed. The prospects for developing more radiation-hardened quartz resonators are discussed and evaluated. Dissert. Abstr.

N81-13766 Iowa Univ., Iowa City.
STUDY OF THE METAL-ELECTROLYTE INTERFACE BY IN SITU PHOTOEMISSION Ph.D. Thesis
David Eugene Grider 1980 216 p
Avail: Univ. Microfilms Order No. 8028616

In situ photoemission was used to study the boundaries between 0.5 M H2SO4 and single crystals of Cu and Au. Correlating structure in the electronic states of these metals with features in the photoelectron quantum yield (photoelectrons/photon), it was possible to specify the energy of certain photoelectrons prior to transmission through the solid liquid interface. The electrolyte level is located in energy near the final states for direct interband transitions near L in Au. By varying the direct interband contribution to the quantum yield through a work function modulation technique, V sub 0 was found to be located at 3.28 eV above the Fermi level of Au at a potential of 0.0 V sub NHE. A feature in the ratio of the p-polarized to s-polarized photoelectron quantum yield from Cu(111) was correlated to the onset of transitions to Bloch-like final states at approximately 4,1 eV. By making use of this feature in the yield ratio, it was possible to monitor the quality of the interface

using both clear and adsorbate (thiourea, Br-,I-, tetrabutylammonium, pyridine) covered Cu surfaces. It was found that the major effect of adsorption of halide ions and thiourea molecules could be attributed to a partial relaxation of the conservation of electron momentum parallel to the surface during the emission process. Dissert. Abstr.

N81-13767 Iowa Univ., Iowa City.
NEUTRON SCATTERING STUDIES OF THE MAGNETIC PROPERTIES AND LATTICE DYNAMICS OF THE MIXED VALENT CeSn3 Ph.D. Thesis
Chun-Keung Loong 1980 227 p
Avail: Univ. Microfilms Order No. 8028620

The electronic and lattice dynamical properties of CeSn were investigated using neutron spectroscopy. The electronic properties of this compound were studied using polarized neutrons and its dynamical properties were investigated by inelastic neutron scattering techniques. In the polarized neutron study the field induced magnetization in CeSn3 was found to be of 4f electronic character in the 40-300 K temperature range. On the other hand, below 40 K the experimental results could be explained by assuming a 4f-5d mixed electronic character for the induced magnetization of the compound. In the inelastic neutron scattering experiment the phonon dispersion curves of CeSn3 and LaSn3 along the /100/,/110/, and /111/ symmetry directions were measured. Anomalously soft modes of CeSn3, as compared with the dispersion curves of LaSn3, were observed close to the zone boundary in the /111/ symmetry direction. These anomalies can be understood qualitatively as a result of the Ce 4f-5d (reaction goes both left and right) electronic transitions in CeSn3 induced by the nuclear motion in the phonon modes.
Dissert. Abstr.

N81-13768 Purdue Univ., Lafayette, Ind.
MICROWAVE STUDIES OF SEMIMAGNETIC SEMICONDUCTORS Ph.D. Thesis
Donald Phillip Mullin 1980 181 p
Avail: Univ. Microfilms Order No. 8027315

Microwave transmission in ternary semiconductors which contain magnetic ions randomly substituted in the lattice is examined. Examples of such materials are HgMnTe and HgMnSe. These semimagnetic semiconductors exhibit some unique physical properties particularly when an external magnetic field is applied. Microwave helicon transmission and related solid state plasma experiments provide measurements of electrical and magnetic properties, e.g., electron paramagnetic resonance (EPR). The propagation of electromagnetic waves in a semimagnetic semiconductor in the presence of an external magnetic field is examined for a plasma of high mobility electrons and low mobility holes in the Faraday geometry. Particular attention is given to the effects introduced by the presence of the holes. The problem of EPR of localized magnetic ions in semimagnetic semiconductors is examined. Finally, attempts to extend the class of semimagnetic semiconductors are discussed. Dissert. Abstr.

N81-13769 Northwestern Univ., Evanston, Ill.
ULTRASONIC STUDY OF A LIQUID CRYSTAL N-A AND A-B PHASE TRANSITION Ph.D. Thesis
Bimal Kumar Sarma 1980 134 p
Avail: Univ. Microfilms Order No. 8026916

Two liquid crystalline phase transitions - the nematic smectic-A phase transition in terephthal-bis-p-p-butylaniline (TBBA) and the smectic-A - smectic-B phase transition in p-butoxybenzylidene-p-otcylaniline (BBOA) were studied by the propagation of longitudinal ultrasound in the MHz range. Strong anomalies in the velocity and attenuation were seen at both transitions. The N-A transition was studied at frequencies 2,4,6, and 10 MHz and at orientations of 0, 30, 45, 60, and 90 deg. The results are in qualitative agreement with a picture involving both critical fluctuations and relaxation of the smectic order parameter, similar to that observed near the lambda transition in liquid helium, but the angular dependence is in strong contradiction to the earlier theories; the data are in better agreement with more recent theories. At the smectic-A - smectic-B(BBOA) transition temperature T sub AB velocity and attenuation change rapidly with a peak in attenuation occuring just below the transition. A small anomaly is also visible some 2-2 1/2 C above the transition at a temperature T. The data is compared with predictions of 2-D melting theory. Dissert. Abstr.

N81-13770 Northwestern Univ., Evanston, Ill.
SURFACE WAVE STUDY OF LIQUIDS AND CRYSTALS Ph.D. Thesis
Cary Hugh Sohl 1980 111 p
Avail: Univ. Microfilms Order No. 8026925

An apparatus for the measurement of surface wave attenuation and wavelength at the liquid gas interface is discussed. It is superior in sensitivity to previous apparatus, does not mechanically touch the fluid surface, and is compact enough to be used in the restricted geometries of high field electromagnets. Because of these features studies of highly viscous fluids and liquid crystals are conveniently done. It is also possible to study surface waves on monolayers as functions of monolayer concentration, without respreading. Experiments were performed on a highly viscous pump fluid, revealing a two mode structure. Experiments on nematic liquid crystals PAA and MBBA proved to be irreproducible due to chemical degradation, but numerical analysis of Brillouin scattering studies proved that surface wave anisotropy should be evident. A study of the nematic to smectic-A transition on CBOOA was performed. By propagating the waves parallel and perpendicular to the magnetic field lines a complete set of shear viscosities and the surface tension were obtained. Analysis of the divergent viscosity gave the critical exponent.
Dissert. Abstr.

N81-13771 Northwestern Univ., Evanston, Ill.
IN-SITU ELECTRICAL RESISTIVITY MEASUREMENTS IN THE HVEM: THE ANISOTROPY OF THE DISPLACEMENT THRESHOLD ENERGY OF COPPER Ph.D. Thesis
Wayne Edward King 1980 247 p
Avail: Univ. Microfilms Order No. 8026838

A side entry helium temperature specimen stage with the capability of making in situ electrical resistivity measurements and electron optical observations on the same specimen at < 10 K was designed for use in the KRATOS 1200 keV high voltage electron microscope at Argonne National Laboratory. Electrical resistivity measurements, which are sensitive to small changes in point defect concentration, were used to determine the damage rate or defect production rate, that is the change in resistivity per incident electron. Damage rate measurements in copper single crystals were carried out for approximately 40 incident electron beam directions and six electron energies. The beam directions were determined by Kikuchi electron diffraction. The total cross section for Frenkel pair production is proportional to the damage and can be calculated if the form of the threshold energy surface is known. The < 110 > region was carefully probed in search of evidence for a very low threshold energy. In an energy dependence experiment with the electron beam incident in this minimum threshold energy direction, defect production was observed at accelerating voltages as low as 150 keV which would correspond to a threshold energy as low as 6 eV. Dissert. Abstr.

N81-13772 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
CATHODOLUMINESCENCE CHARACTERIZATION ION IMPLANTED GaAs Ph.D. Thesis
Milton Lee Cone 1980 132 p
Avail: Univ. Microfilms Order No. 8028554

Depth-resolved cathodoluminescence was used to study ion implanted GaAs. A model for the luminescence from ion implanted GaAs was developed which includes a Monte Carlo simulation of electrons penetrating into GaAs. The result of this calculation is a prediction of luminescent intensity as a function of electron beam energy. This calculation differs from preceding ones in that the ion implanted profile is specifically included in the analysis. The model was validated by a suitable experiment that confirms the theoretical predictions. The luminescence measurements were made on Mg ions implanted into epitaxial GaAs. The results include the identification of many of the lines in the Mg implanted GaAs spectrum from 1.32 ev to 1.52 ev, a study of the effect of changing the current of the electron beam on the spectra and a comparison of the theoretical and experimental luminescence curves. These results show that changing the current density at the sample surface dramatically changes the spectra and that

good agreement exists between the theoretical and experimental luminescence curves. Dissert. Abstr.

N81-13773 Illinois Inst. of Tech., Chicago.
PROBLEMS WITH THE STARK EFFECT IN F-CENTER Ph.D. Thesis
Michael Jayabalan Ponnambalam 1980 156 p
Avail: Univ. Microfilms Order No. 8026163

Although the F-center in an alkali halide looks like a hydrogenic system its potential has a cubic--and not coulombic--symmetry. Hence, there is no a priori reason to assume the first excited state of the F-center to be fourfold degenerate as in a hydrogen atom. The excited state of the F-center in the absence of electron lattice interaction is assumed to consist of a singlet and a degenerate triplet. In emission, the singlet state is taken to lie below the triplet state by an amount of energy. During relaxation, the electron lattice interaction would mix these states into each other, if the effect of the farther lying states was investigated. These relaxed excited states (RES) were analyzed to obtain insight into the strength of the electron-lattice interaction. Using the adiabatic approximation, the RES are linear combinations of the electronic wavefunctions with their coefficients depending upon the lattice vibrational coordinates. It is found that the lowest energy surface develops a quasi-static Jahn-Teller instability. Dissert. Abstr.

N81-13774# Harry Diamond Labs., Adelphi, Md.
OPTICAL SPECTRA OF Yb-3(+) IN CRYSTALS WITH SCHEELITE STRUCTURE. 2: CRYSTAL-FIELD CALCULATIONS AND A PHENOMENOLOGICAL CRYSTAL-FIELD MODEL
Edward A. Brown Sep. 1980 40 p refs
(AD-A090976; HDL-TR-1934) Avail: NTIS HC A03/MF A01 CSCL 20/2

In a previous report we presented the results of a series of measurements of the optical and Zeeman spectra of trivalent ytterbium doped into the following members of the scheelite family of crystalline hosts: cadmium molybdate (CdMoO4), calcium tungstate (CaWO4), calcium molybdate (CaMoO4), strontium tungstate (SrWO4), strontium molybdate (SrMoO4), lead tungstate (PbWO4), lead molybdate (PbMoO4), barium tungstate (BaWO4), and lithium yttrium fluoride (LiYF4). Measurements were made at temperatures varying from below the lambda point of liquid helium up to room temperature on samples with impurity ion concentrations varying from 0.05 to 4.0 percent Yb. The results were the identification of the electronic transitions, both absorption and fluorescence, and the measurement of the g factors of the lowest J = 5/2 state. The objective of this report is to take these experimental results and from them derive a self-consistent set of crystal-field parameters. Following this calculation, using the conventional approach of the electrostatic point charge model, we calculate a similar set of crystal-field parameters to compare with the experimentally determined ones. GRA

N81-13775# University of Southern California, Los Angeles. Electronic Sciences Lab.
GROWTH AND CHARACTERIZATION OF EPITAXIAL PIEZOELECTRIC AND SEMICONDUCTOR FILMS Final Report, 1 Jun. 1979 - 31 Jul. 1980
K. M. Lakin and S. K. Tiku Jul. 1980 29 p refs
(Contract F49620-79-C-0138; AF Proj. 2306)
(AD-A091342; AFOSR-80-1073TR) Avail: NTIS HC A03/MF A01 CSCL 20/3

This report contains details of the research work carried out on a one-year project on the growth and characterization of ZnO and AlN piezoelectric thin films. Material growth systems are reported for ZnO using the zinc vapor reaction with CO2, ZnCl2 with O2, and the latest metal-organic process. The growth of insulating ZnO has been achieved using lithium doping during film growth. Initial results are reported for a new AlN growth process that shows promise of overcoming some previous growth problems. GRA

N81-13776# Ballistic Research Labs., Aberdeen Proving Ground, Md.
COLLISION-INDUCED TRANSFER RATES CONNECTING FINE STRUCTURE LEVELS IN DIATOMIC SULFUR IN AN EXCITED VIBRATIONAL LEVEL WHERE V PRIME EQUALS 4
Thomas A. Caughey and David R. Crosley Aug. 1980 34 p refs Sponsored in part by NSF and E. I. DuPont de NeMours Co.
(AD-A091248; AD-E430518; ARBRL-TR-02259) Avail: NTIS HC A03/MF A01 CSCL 07/4

Rates for collision-induced transfer between a single rotational level (v = 4, J = 41) and other individual rotational levels within the same vibrational level of the B-state of diatomic sulfur are reported. The sulfur was excited into the B-state by the radiation from an atomic zinc lamp, and rotationally resolved fluorescence measurements were used to determine the rates for the collision partners He, Ar and Xe. GRA

N81-13777# Harry Diamond Labs., Adelphi, Md.
OPTICAL SPECTRA OF Yb(3+) IN CRYSTALS WITH SCHEELITE STRUCTURE. 1: EXPLANATION OF THE SPECTRA
Edward A. Brown Sep. 1980 53 p refs Sponsored by Army Materials Development and Readiness Command Alexandria, Va.
(AD-A091252; HDL-TR-1932) Avail: NTIS HC A04/MF A01 CSCL 20/2

The optical and Zeeman spectra are reported for Yb(3&) in nine single crystals of the Scheelite family at temperatures varying between 1.9 and 300 K and impurity ion concentration varying between 0.05 and 4 percent. The scheelite crystals examined were CaWO4, CaMoO4, SrWO4, SrMoO4, PbWO4, PbMoO4, Cd-MoO4, BaWO4, and LiYF4. The Yb(3&) ion substitutes for the cation and experiences a crystalline electric field of S4 point symmetry. The spectra were found to be highly structured containing the S4 electronic transitions, concentration dependent lines originating from low symmetry sites caused by lattice defects, and features tentatively identified as vibronic transitions. Vibronic selection rules for Yb(3&) in scheelite, which belongs to the C(6)4h space group, have been calculated. Identification of the S4 spectral lines allowed the energy level schemes for Yb(3&) in the nine scheelites to be determined. GRA

N81-13778# Rockwell International Science Center, Thousand Oaks, Calif. Electronics Research Center.
GaAs SURFACE PASSIVATION FOR DEVICE APPLICATIONS Interim Report, 3 Dec. 1979 - 31 Mar. 1980
R. W. Grant, J. R. Oliver, S. P. Kowalczyk, J. R. Waldrop, and D. L. Miller Wright-Patterson AFB, Ohio AFWAL Jul. 1980 32 p refs
(Contract F33615-78-C-1591)
(AD-A091304; ERC-41051-151IRT; AFWAL-TR-80-1104) Avail: NTIS HC A03/MF A01 CSCL 20/12

Three samples of MBE grown graded Al(1-x)Ga(x)As epitaxial layers on GaAs have been prepared. The initial oxidation procedure used on these samples produced only a superficial oxide layer as determined by SAM analysis. C-V and G-V results have been obtained for the initial oxidized specimens and for a specimen of sample 411 which was given a subsequent additional oxidation treatment. During the next reporting period a systematic C-V study as a function of oxidation conditions will be carried out. An initial attempt to deposite an aluminum oxide layer by evaporating Al in an oxidizing atmosphere was unsuccessful which suggests that a much more oxidizing ambient (perhaps a plasma discharge) needs to be utilized if this approach is to be pursued. GRA

N81-13779# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
THE MOBILITY, RESISTIVITY AND CARRIER DENSITY IN P-TYPE SILICON DOPED WITH BORON, GALLIUM AND INDIUM Ph.D. hesis
Luis Carlos Linares Aug. 1979 175 p refs
(AD-A091310; AFIT-Ci-79-232D) Avail: NTIS HC A08/MF A01 CSCL 20/12

The goal of this study has been to measure and compare with theory the resistivity and Hall mobility of holes in silicon doped with gallium and indium as functions of temperature and dopant density. Data taken on boron-doped silicon was also included in order to further confirm the adequacy of the theoretical model. In order to determine theoretically the resistivity and

Hall mobility, one must first calculate the conductivity mobility, the density of holes, and the Hall factor. This can only be done with a thorough understanding of the energy band structure, the scattering mechanisms involved, and the carrier statistics. The application of an electric or a magnetic field to a crystal results in a variety of carrier transport phenomena. These phenomena are associated with the motion of current carriers in the conduction or valence bands. The free charge carrier in a semiconductor will acquire a drift velocity under the influence of an applied electric field. This velocity is the net result of the momentum gained from the externally applied field, and the momentum lost in collisions which tend to randomize the carrier momentum. GRA

N81-13780# Sandia Labs., Albuquerque, N. Mex.
RETENTION, ISOTOPE EXCHANGE, AND THERMAL RELEASE OF HYDROGEN IN LOW Z MATERIALS
W. R. Wampler, B. L. Doyle, and D. K. Brice 1980 29 p refs
(SAND-80-1745C; CONF-8006125-1) Avail: NTIS HC A03/MF A01

Hydrogen retention, hydrogen isotope exchange, and thermal release measurements for low-z coatings and claddings are evaluated as candidate materials for use in toroidal fusion test reactors. The materials used in TFTR will be exposed to high fluxes of hydrogen, deuterium, and tritium ions and neutrals with energies in the range of tens to thousands of electron volts. Retention and release of this hydrogen grossly affects the plasma density, temperature, and isotopic composition during operation of TFTR. In addition, it is important to know how much tritium the materials will retain; and, therefore, processes which result in release of tritium from the materials, such as thermal detrapping and replacement by hydrogen or deuterium, must be understood. For these reasons the hydrogen retention, isotope exchange, and thermal release characteristics of the various materials must be taken into consideration in selecting a material suitable for use in TFTR. S.F.

N81-13781# Sandia Labs., Albuquerque, N. Mex.
ION IMPLANTATION-INDUCED PHASE SEPARATION AND CRYSTALLIZATION IN LITHIA-SILICA GLASSES
G. W. Arnold, P. S. Peercy, and B. L. Doyle 1980 26 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-0823C; CONF-800744-5) Avail: NTIS HC A03/MF A01

Crystallization of annealed Li2O 2SiO2 glasses implanted with inert ions and fused SiO2 glass implanted with Li ions was monitored using infrared reflection spectroscopy. Elastic recoil detection analysis was used to study changes in the Li and H concentration induced in these glasses by implantation and annealing. Implantation of Li2O 2SiO2 with inert ions results in Li depletion, accompanied by H indiffusion, in the implanted region. For Li-implanted SiO2, crystallization of alpha-quartz is accompanied by appreciable Li diffusion to the surface and attendant H migration to the Li-depleted region. The crystallization mechanisms are discussed in terms of phase separation in the lithia-silica system. Author

N81-13782# Sandia Labs., Albuquerque, N. Mex. Solid State Device Physics Div.
PRESSURE SENSITIVITY OF A GaAs FET OSCILLATOR
Richard A. Kiehl Oct. 1980 25 p refs
(SAND-80-2099) Avail: NTIS HC A02/MF A01

Results on the effect of hydrostatic pressure on the frequency of a GaAs FET microwave oscillator are presented. The oscillator is a common source configuration in which the output circuit reactance is determined by the inductance and capacitance of the pressure system test fixture. Frequency shift is primarily caused by variations in the output circuit capacitance resulting from pressure induced changes in the permittivity of the FET's surroundings. Suggestions are made for utilizing the sensitivity of such an oscillator configuration for developing highly sensitive pressure transducers. S.F.

N81-13783# Sandia Labs., Albuquerque, N. Mex.
GaP, GROWN JUNCTION, HIGH TEMPERATURE DIODES
Progress Report
R. J. Chaffin Aug. 1980 25 p refs
(Contract DE-AC04-76DP-00789)
(SAND-80-1763) Avail: NTIS HC A02/MF A01

Current results of an effort to develop gallium phosphide diodes for high temperature (greater than 275 C) applications are discussed. The theory, fabrication and testing of devices are detailed. DOE

N81-13784# Sandia Labs., Albuquerque, N. Mex.
HIGH TEMPERATURE PERFORMANCE OF MOS TECHNOLOGIES
B. L. Draper, J. D. McBrayer, J. L. Prince, and L. T. Fitch 1980 8 p refs Presented at the Systems Users Group Gen. Meeting, New Orleans, 29 Jan. 1980 Prepared in cooperation with Clemson Univ., S.C.
(Contract DE-AC04-76DP-00789)
(SAND-80-1190C; CONF-800108-2) Avail: NTIS HC A02/MF A01

Information is given which makes more versatile high temperature circuit design possible through the introduction of metal oxide semiconductor components. Basic design guidelines and experimental results are presented. DOE

N81-13785# Stanford Univ., Calif. Dept. of Materials Science and Engineering.
PHOTOELECTRONIC PROPERTIES OF ZINC PHOSPHIDE CRYSTALS, FILMS AND HETEROJUNCTIONS Quarterly Report, 1 Apr. - 30 Jun. 1980
Richard H. Bube 1980 12 p refs
(Contract DE-AC02-77CH-00178)
(SERI/PR-8031-1-T1; QPR-5) Avail: NTIS HC A02/MF A01

Growth of zinc phosphide crystals using a chemical transport method with iodine as the transport agent produced a successful growth run with greatly enhanced growth rate. The electrical properties of the crystal appear to be unaffected by the iodine transport agent. This method is explored as an alternative to thermal diffusion for doping of Zn3P2. Hall effect measurements were made on several Zn3P2 crystals as a function of temperature. The mobility varies with temperature in the expected way for lattice scattering at higher temperatures and charged imperfection scattering at lower temperatures. DOE

N81-13786# National Bureau of Standards, Washington, D.C. National Engineering Lab.
CALCULATION OF FLUORESCENT EFFICIENCY FROM EXPERIMENTAL DATA BY THE HUYGENS PRINCIPLE
Yardley Beers May 1980 36 p refs
(PB80-219835; NBS-TN-1020) Avail: NTIS HC A03/MF A01 CSCL 20L

The calculation of internal fluorescent efficiencies of semiconductors, especially amorphous silicon, is discussed. The Huygens Principle method, which gives the intensity of the emitted light in terms of the power of an array of point sources in the semiconductor, is examined. Huygens Principle is directly applied to the individual waves that are multiply reflected by the boundary surfaces. The results are given in terms of the constants of the materials, the dimensions, and three quantum numbers: (1) P, the number of two-way trips in the semiconductor: (2) Q, the number of round trips in the substrate; and (3) S, the number of two-way penetrations of the boundary between them. The method is useful for radiation emerging nearly normal to the surfaces. GRA

N81-13787# RCA Labs., Princeton, N. J.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY: METHOD TO DETERMINE THE QUALITY OF SAPPHIRE Final Report
M. T. Duffy, P. J. Zanzucchi, W. E. Ham, J. F. Corbov, and G. W. Cullen Aug. 1980 77 p refs
(Contract NBS-5-35915; ARPA Order 2397)
(PB80-212830; PRRL-79-CR-33; NBS/SP-400-62; LC-80-600103) Avail: NTIS HC A05/MF A01 CSCL 20L

Specular reflectance measurements were used in the quantitative characterization of sapphire and silicon surfaces. Residual polishing damage in sapphire surfaces is easily detected by infrared multiple reflectance measurements in the lattice band region of sapphire. Specular reflectance measurements in the ultraviolet was used for the surface characterization of bulk silicon surfaces and silicon films on sapphire. The reflectance

methods were applied to the characterization of variously polished sapphire surfaces and to the characterization of heteroepitaxial silicon films grown on the substrates. Measured device parameters include drain current, extrapolated threshold voltage, leakage current, and drain breakdown voltage. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N81-13788 Illinois Univ. at Urbana-Champaign.
***KINETIC SOLVENT EFFECTS ON POLAR REACTIONS* Ph.D. Thesis**
Thomas Charles Long 1980 109 p
Avail: Univ. Microfilms Order No. 8026550

Thermodynamic principles are applied to the problem of estimating the effect of solvent on the rate of chemical reaction. Activated complex theory and linear free energy relationships (LFER) are utilized to reduce the problem of estimating rates to one of solution thermodynamics. The infinite dilution regime provides the simplest theoretical approach to solution thermodynamic problems, as the order-disorder problem is trivial. Along these lines, a gas chromatographic technique was used to determine infinite dilution activity coefficients (gamma infinity) of various solutes in several industrially important solvents. Good agreement was found with previously reported data. The technique is shown to be of great value in the rapid and accurate measurement of gamma infinity values. LFER theory is successfully applied to correlation of rate data for seven Menchutkin reactions (tertiary amine plus alkyl halide). The solvent parameters determined from this data base are then applied to several reactions exhibiting a much lower polarity. Good correlation is shown for two Diels-Alder cycloadditions, a third with virtually nonpolar character, is only poorly fitted. Dissert. Abstr.

N81-13789 Purdue Univ., Lafayette, Ind.
THERMODYNAMIC PROPERTIES OF FLUIDS, EXPERIMENTAL DETERMINATION AND PREDICTION USING THE *PRINCIPLE OF CORRESPONDING STATES* Ph.D. Thesis
Ray Allen Mentzer 1980 353 p
Avail: Univ. Microfilms Order No. 8027306

The shape factor of corresponding states theory using methane as the reference fluid is examined to determine its usefulness for the prediction of phase equilibrium of pure fluids and their mixtures beyond the methane to pentane range. Vapor pressure and saturated fluid densities of both nonpolar and polar molecules are studied to give indications of the applicability of the method to their mixtures. The vanderWaals one fluid model is used to represent mixture behavior. Two binary interaction parameters are introduced and their values determined for each of the binary systems studied. Equilibrium ratios are calculated for binary mixtures of methane, carbon dioxide, hydrogen, and hydrogen sulfide with various hydrocarbons. Henry's constants and saturated fluid densities of binary mixtures, and bubble points of ternary mixtures are predicted using binary interaction parameters determined from the bubble point pressures and equilibrium ratios of binary systems. The predictions are compared with experimental results. Vapor-liquid equilibrium data, in terms of excess Gibbs free energies, are calculated for binary mixtures of polar and nonpolar molecules. Dissert. Abstr.

N81-13790# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
QUANTITATIVE DIFFERENTIAL THERMAL ANALYSIS STUDY OF THE U3O8-Al THERMITE REACTION
A. E. Pasto, G. L. Copeland, and M. M. Martin 1980 25 p refs Presented at the 82d Ann. Am. Ceram. Soc. Meeting, Chicago, 27 Apr. 1980
(Contract W07405-eng-26)
(CONF-800460-5) Avail: NTIS HC A02/MF A01

Concerns about proliferation resistance of nuclear fuel cycles and fuels have prompted a reinvestigation of U3O3-Al cermet fuels currently being used in research and test reactors. In particular, higher loadings of U3O8 are being considered. These new fuel compositions are in the region of maximum possible thermal energy release from the high temperature thermite reaction between the U3O3 and aluminum components. This study was initiated to quantitatively measure the amount of reaction heat evolved. A differential thermal analysis system was calibrated with materials of known heat of reaction. Subsequently, specimens of high uranium loaded U3O3-Al powder mixtures were analyzed. Thermite reaction heat measured for these specimens was much lower than expected. Specimens of simulated fuel plates showed similar low results. Possible reasons for this behavior are discussed. DOE

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N81-13791 Northwestern Univ., Evanston, Ill.
INFORMATION USE IN DECISION-MAKING: THREE CASE* STUDIES FOCUSING UPON THE USE OF CRITERIA IN THE DECISION-MAKING PROCESS *Ph.D. Thesis
Vicki Lynn Sauter 1980 348 p
Avail: Univ. Microfilms Order No. 8026917

An in depth case study methodology involving three groups of decisions was used in the development of a conceptual model relating characteristics of a decision maker and his choice context to his needs for information. Three decision factors, external resource support, product effectiveness, and internal resource conversion, were identified as the principal determinants of decision makers' user of information. External resource support is the environmental factor that encourages or inhibits the survival capabilities of the alternative. Product effectiveness reflects the overall ability of a product (or program) to meet the needs and goals of decision makers. Finally, internal resource conversion addresses the ability of the alternative to efficiently convert inputs into outputs. The results suggest the existence of a hierarchy among the three factors that is dependent upon both a decision makers' confidence in the alternative and his confidence in the information that is provided. Dissert. Abstr.

N81-13792 Northwestern Univ., Evanston, Ill.
***PROCUREMENT OF EVALUATION SYSTEMS: A CASE STUDY OF THE PARAMETRIC FACTOR EVALUATION* APPROACH TO SOURCE SELECTION Ph.D. Thesis**
Ardwin Stanley Libman 1980 589 p
Avail: Univ. Microfilms Order No. 8026856

The specific problem for which the technique was used was the selection of two contractors to develop an ongoing capability to evaluate the results (agency and commercial impacts) of experimental modifications in procurement procedures by selected federal, state, and local government agencies. These evaluation systems were to be implemented by organizations outside of the developing organization. The primary administrative finding is that the federal program was able to adapt successfully the technique, which was developed and used to procure 'hardware' systems, to meet its requirements to select contractors to develop these 'software' systems. The primary research contribution is the offering of an evaluation structure and an example of its use for future case studies of source selection techniques.
Dissert. Abstr.

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N81-13793 *Texas Univ. at Dallas.*
CONTROLLING CONCURRENCY IN DATABASE SYSTEMS Ph.D. Thesis
Donald Spencer Fussell 1980 115 p
Avail: Univ. Microfilms Order No. 8028550

The use of locking and unlocking instructions which control access to units of shared data by the processes are described. These instructions are embedded in the processes according to *rules which are called locking protocols. A correct locking protocol* guarantees that the consistency of the database is preserved and that all concurrent processes will be able to terminate. A *theory of how the a priori* syntactic information provided by the structure of a given database about the behavior of the processes which access it can be used to develop correct locking protocols is presented. This theory is based on the representation of the relevant information as a directed hypergraph. The basic framework *of the theory, which lead to the discovery of several natural* classes of locking protocols was developed. Examples of specific correct locking protocols for specific database structures are given. Dissert. Abstr.

N81-13794 Princeton Univ., N. J.
FUNCTIONAL DEPENDENCIES AND THE UNIVERSAL INSTANCE PROPERTY IN THE RELATIONAL MODEL OF DATABASE SYSTEMS Ph.D. Thesis
Peter Honeyman 1980 70 p
Avail: Univ. Microfilms Order No. 8027703

An algorithm was developed for testing satisfaction of a set of functional dependencies by a set of relations. It was demonstrated that testing a database for the existence of a universal instance is NP-complete. However, in an important subset of the lossless decompositions, including independent components and decomposition into Third Normal Form, an efficient algorithm which tests the property was developed. The same algorithm can be used to losslessly join relations. Possible extensions of the work are discussed. Dissert. Abstr.

N81-13795 Purdue Univ., Lafayette, Ind.
AN INTEGRATED IMAGE ANALYSIS AND IMAGE DATABASE MANAGEMENT SYSTEM Ph.D. Thesis
Ning-San Chang 1980 206 p
Avail: Univ. Microfilms Order No. 8027263

An integrated database system interfaced with an image understanding system for the efficient storage, retrieval and manipulation of pictorial information is described. By using image processing and pattern recognition manipulation functions, structures and features of images are extracted and integrated into relational databases. A relational query language, Query by Pictorial Example (QPE) is introduced for manipulating queries regarding pictorial relations as well as conventional queries. In addition to the manipulating capabilities of the usual query languages, queries can also be expressed in terms of pictorial examples through a display terminal. A parallel parsing algorithm for tree languages is presented for the implementation of a more efficient Error Correcting Tree Automata (ECTA). It is then used to recognize features from images. The conversion of a relational graph to relational database is discussed. Capabilities of QPE are discussed and data representation and manipulation algorithms for QPE are presented. Dissert. Abstr.

N81-13796# Army Combined Arms Combat Developments Activity, Fort Leavenworth, Kans.
REVISED DOCUMENT CONTROL SYSTEM USER'S MANUAL. PROGRAMMER'S MANUAL
Robert H. Kaeding Sep. 1980 94 p
(AD-A090919; CACDA-TR-12-80) Avail: NTIS
HC A05/MF A01 CSCL 05/2

The Document Control System (DCS) described in this report was developed to provide the Combined Arms Studies and Analysis Activity with an automated system for controlling, maintaining, *and locating the various documents located within the Activity.* The system was originally designed for the TEKTRONIX 4051 but the ever increasing number of documents soon became over-burdening resulting in excessive retrieval time. The present system represents a conversion to the CDC 6500 utilizing the existing data management system, System 2000. This report contains a general description of the system's structure and capabilities, a user's manual, a programmer's manual, and a glossary of keywords. GRA

N81-13797# Naval Ocean Research and Development Activity, *Bay St. Louis, Miss.*
OCEANOGRAPHIC MANAGEMENT AND INFORMATION SYSTEM (OMIS): THE NAVY OCEANOGRAPHIC PROGRAM, DATABASE
S. Wasowski Sep. 1980 14 p
(AD-A091186; NORDA-TN-67) Avail: NTIS
HC A02/MF A01 CSCL 08/10

The Navy's Oceanographic Program (NOP) contains many *diverse projects in a wide variety of scientific and technological* disciplines. The NOP database is a collection of information pertaining to the current projects of the Navy's oceanographic *community, the objective of the database is* to provide an information tool to management. Data elements include project title, performing organization and principal investigator, sponsor, program element funding, and a classification of the project's purpose using a closed vocabulary keywork system. GRA

N81-13798# Midwest Research Inst., Kansas City, Mo.
ENVIRONMENTAL ASSESSMENT DATA SYSTEMS USER GUIDE: FINE PARTICLE EMISSIONS INFORMATION SYSTEM Final Report, Sep. 1978 - Sep. 1979
J. P. Reider and R. J. Larkin Jan. 1980 290 p Prepared in cooperation with Acurex Corp., Mountain View, Ca.
(Contracts EPA-68-02-2641; EPA-68-02-2699)
(PB80-222433; EPA-600/8-80-007) Avail: NTIS
HC A13/MF A01 CSCL 05B

The Fine Particle Emissions Information System (FPEIS) is guided to a computerized data base on particulate emissions from stationary point sources. The guide gives detailed instructions for encoding FPEIS data sets, defines procedures for submitting and retrieving data, and contains standard nomenclature to facilitate data encoding. It also contains a program library that describes analytical software available to the user and provides instructions for its use. Procedures which will allow its users to access the FPEIS are also discussed. GRA

N81-13799# Acurex Corp., Mountain View, Calif. Energy and Environmental Div.
ENVIRONMENTAL ASSESSMENT DATA SYSTEMS USER GUIDE: SOLID DISCHARGE DATA SYSTEM Final Report, Sep. 1978 - Sep. 1979
R. J. Larkin, ed. Jun. 1980 265 p
(Contract EPA-68-02-2699)
(PB80-212482; EPA-600/8-80-009) Avail: NTIS
HC A12/MF A01 CSCL 05B

A user guide to the Solid Discharge Data System, a computerized data base on solid waste discharges from stationary point sources, is described. The SDDS is one of four waste stream data bases which are components of the Environmental Assessment Data Systems. The EADS concept is designed to aid researchers in environmental assessment, emissions characterization, and control technology development. The SDDS contains data from source sampling which may include: design and typical operating data on control technology applied to the solid waste effluent stream; analysis of any fuel or feedstock to the process producing the effluent stream; results of chemical, physical, radiological, and biological/ecological tests of solid waste samples; process descriptions of the sources; and descriptions of the sampling equipment and techniques employed. GRA

N81-13800# Institute for Scientific Information, Inc., Philadelphia, Pa.
APPLICATION OF BIBLIOMETRIC METHODS TO THE ANALYSIS AND TRACING OF SCIENTIFIC DISCOVERIES Final Report
Henry Small Dec. 1979 111 p refs Sponsored by National

Inst. of General Medical Sciences
(PB80-210586; NIGMS-79-301) Avail: NTIS HC A06/MF A01 CSCL 05B

The ability of two related bibliometric methodologies (citation historiographs and co-citation clusters) to detect transitions between basic and clinical (applied) biomedical research is tested. *Data on three areas of research were collected and analyzed:* Lesch-Nyhan syndrome, Tay-Sachs disease, and the effects of the drug methotrexate. In the first two cases, a transition from *basic research on enzymes to clinical research on human disease* was anticipated, and, in the third case, clinical research on a drug was expected to lead to work in basic cell biology. In each of the cases, the citation historiograph methodology was able to detect the anticipated transitions. Co-citation cluster *methodology was capable of indicating the basic or clinical* orientation of these research areas, but the sought-for transition points could not be observed. GRA

N81-13801# Computer Corp. of America, Cambridge, Mass.
***AN ANALYSIS OF REQUIREMENTS FOR THE CHEMICAL SUBSTANCES INFORMATION NETWORK, VOLUME 1* Final Technical Report**
Gerald A. Wilson, Jane E. Barnett, Bennett D. Marks, and Carol S. Kulp Jun. 1980 107 p
(Contract EQ8AC028)
(PB80-222458; CCA-80-07-Vol-1; EQ-5178130281) Avail: NTIS HC A06/MF A01 CSCL 05B

Based on personal interviews, examination of computerized data bases and numerous nonautomated information sources, and factfinding at 20 organizations, this analysis provides a base of information about current and projected needs of the user community. Availability of these data facilitates system design and management decisions. There is no appropriate connection between users information needs and existing information gathering tools. GRA

N81-13802# Computer Corp. of America, Cambridge, Mass.
AN ANALYSIS OF REQUIREMENTS FOR THE CHEMICAL SUBSTANCES INFORMATION NETWORK. VOLUME 2: APPENDICES Final Technical Report
Gerald A. Wilson, Jane E. Barnett, Bennett D. Marks, and Carol S. Kulp Jun. 1980 202 p refs
(Contract EQ8AC028)
(PB80-222466; CCA-80-07-Vol-2; EQ-5178130282) Avail: NTIS HC A10/MF A01 CSCL 05B

A base of information about current and projected needs of the user community is provided. Availability of these data facilitate system design and management decisions. There is no appropriate connection between users' information needs and existing information-gathering tools. Appendices are contained in this volume. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N81-13213*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
LIFE-CYCLE COST ANALYSIS TASK SUMMARY
M. McKenzie *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 33-43 ref (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 05C

N81-13232*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AN ESTIMATING RULE FOR DEEP SPACE STATION CONTROL ROOM EQUIPMENT ENERGY COSTS
H. C. Younger *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 183-184 (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 09C

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N81-13391# *Food and Agriculture Organization of the United* Nations, Rome (Italy).
THE FOOD AND AGRICULTURE ORGANIZATION (FAO) OF THE UN PROJECT RELATED TO AGROECOLOGICAL ZONES [LE PROJET RELATIF AUX ZONES AGROECOLOGIQUES]
Michel Frere *In* ESA Satellite Remote Sensing Appl. in Agroclimatol. and Agrometeorol. Apr. 1980 p 11-13 refs In FRENCH (For primary document see N81-13388 04-42)
Avail: NTIS HC A07/MF A01

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see 03 *Air Transportation and Safety*, 16 *Space Transportation*, and 44 *Energy Production and Conversion*.

N81-13803*# Cummins Engine Co., Inc., Columbus, Ind.
VEHICLE TESTING OF CUMMINS TURBOCOMPOUND DIESEL ENGINE Final Report
Michael C. Brands, John R. Werner, and John L. Hoehne Jun. 1980 64 p refs
(Contracts EM-78-C-02-4936; EC-77-A-31-1011)
(NASA-CR-159840; DOE/NASA/4936-80/1; CTR-0746-80002) Avail: NTIS HC A04/MF A01 CSCL 13F

Two turbocompound diesel engines were installed in Class VIII heavy-duty vehicles to determine the fuel consumption potential and performance characteristics. One turbocompound powered vehicle was evaluated at the Cummins Pilot Center where driveability, fuel consumption, torsional vibration, and noise were evaluated. Fuel consumption testing showed a 14.8% benefit for the turbocompound engine in comparison to a production NTC-400 used as a baseline. The turbocompound engine also achieved lower noise levels, improved driveability, improved gradeability, and marginally superior engine retardation. The second turbocompound engine was placed in commercial service and accumulated 50,000 miles on a cross-country route without malfunction. Tank mileage revealed a 15.92% improvement over a production NTCC-400 which was operating on the same route. Author

N81-13804*# National Aeronautics and Space Administration, Washington, D. C.
PRODUCTIVITY IN AEROSPACE RESEARCH AND DEVELOPMENT
1980 62 p refs
(NASA-TM-82388) Avail: NTIS Avail: NTIS $8.00 North American, all others $16.00 CSCL 05A

The concept of productivity in a Federal research and development agency is multifaceted and complex. Four approaches were considered: the contribution of NASA to national productivity external to the agency; the use of new technology to increase the output of NASA's R&D effort; the achievement of management improvement which involves planning, organization, staffing, direction, and control; and the efficiency with which the agency's civil service labor resources are used to produce goods and services. Author

N81-13805# Committee on Science and Technology (U. S. House).
UNITED STATES-MEXICO SCIENTIFIC AND TECHNOLOGICAL COOPERATION
Washington GPO 1979 292 p Hearings before the Subcomm. on Sci., Res. and Technol. of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., no. 90, 4 Jun., 16 and 18 Jul. 1979 (GPO-55-120) Avail: Subcommittee on Science, Research and

Technology

The effect of technology transfer on foreign trade, economic development, energy resources, immigration, and unemployment are discussed. Particular emphasis is placed on Mexico's oil reserves and the United States' agricultural technology. T.M.

N81-13806# Committee on Science and Technology (U. S. House).

TECHNICAL INFORMATION FOR CONGRESS

Washington GPO 1979 1007 p refs Presented to the Subcomm. on Sci., Res. and Technol. of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., Jul. 1979 Prepared by Congressional Research Service, Library of Congress

(GPO-37-443) Avail: GPO HC

The leadtime in the making of Congressional decisions on technical matters can be shortened by improving the management of technical information and by collecting, in advance, reliable, factual information on potential issues, uncolored by political controversy, and unhurried by the pressures of urgent need. Case studies are presented and analyzed to show the historical strengths and weaknesses of various congressional processes for obtaining technical advice. Selected contemporary examples of technology assessments are considered as well as the creation, testing, and prospects of the Office of Technology Assessment. A bibliography of policy oriented literature is included along with appendices showing legislation relating to technology assessment, lists of OTA publications, and brief summaries of recent assessment (to 1978). A.R.H.

N81-13807# Committee on Science and Technology (U. S. House).

OVERSIGHT: APPROPRIATE TECHNOLOGY, VOLUME 1

Washington GPO 1979 231 p refs Joint hearing before the Subcomm. on Energy Develop. and Appl. of the Comm. on Sci. and Technol. and the Subcomm. on Energy Conserv. and Supply of the Comm. on Energy and Nat. Resources, 96th Congr., 1st Sess., no. 20, 30 Apr. 1979

(GPO-47-419) Avail: SOD HC

The importance of management and public relations in energy development is discussed. Solar energy technology and synthetic fuels technology were examined. Conservation of energy in homes is viewed as the major resolution of energy problems facing society. T.M.

N81-13808# Committee on Science and Technology (U. S. House).

GOVERNMENT AND INNOVATION: FIELD HEARINGS

Washington GPO 1980 463 p Hearings before the Subcomm. on Sci., Res. and Technol. of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., no. 82, 7-8 Sep. 1979

(GPO-55-795) Avail: Subcommittee on Science, Research and Technology

Intergovernmental utilization of science and technology is discussed. Federal budget considerations for appropriations in research and development were examined. The cost of governmental technology transfer was estimated. T.M.

N81-13809# Committee on Science and Technology (U. S. House).

TECHNOLOGY TRANSFER CONFERENCE

Washington GPO 1980 215 p Hearing before the Subcomm. on Sci., Res. and Technol. of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., no. 101, 30 Mar. 1979

(GPO-56-537) Avail: Subcommittee on Science, Research and Technology

Intergovernmental communication and technology sharing are discussed. The importance of information dissemination between Federal, State, and local governments was examined. Information management and its importance in general government efficiency was also examined. T.M.

N81-13810# Department of Energy, Washington, D. C.

LOAD CONDITIONS FOR A STORAGE BATTERY, THREE-PHASE VOLTAGE INVERTER AND ASYNCHRONOUS TRACTION MOTOR DURING ACCELERATION OF AN AUTOMOBILE AT SET INTENSITY

B. E. Pavlushkov 1979 8 p Transl. into ENGLISH from 2d Soviet-Am. Symp. on Elec. Automobiles (USSR), 1979 Conf. held at Yerevan, USSR, 1979

(DOE-TR-228) Avail: NTIS HC A02/MF A01

In the electric drive system of an electric automobile the operating conditions for the storage battery, self-contained voltage inverter and asynchronous traction motor are determined to a significant degree by the pulse nature of the electromagnetic processes accompanying the formation and regulation of a three phase voltage in accordance with the accepted laws for control of the ATM. This factor must be fully considered when calculating the currents of the SB and SI rectifiers and the current, magnetic flux and torque of the ASM. A mathematical model is developed which permits the calculation of instantaneous values of these electromagnetic values as a function of time, voltage frequency and motor rotor rpm's. DOE

N81-13811# Department of Energy, Washington, D. C.

RECTIFIER ELECTRIC DRIVE FOR AN ELECTRIC AUTOMOBILE USING A NON-CONTACT SYNCHRONOUS MOTOR WITH PERMANENT MAGNETS

V. G. Yapuk [1979] 7 p refs Transl. into ENGLISH from Soviet-American Symp. paper Presented at 2d Soviet-American Symp. on Electric Automobiles, Yerevan, USSR, 1979

(DOE-TR-234) Avail: NTIS

A traction electric drive for an electric automobile using a rectifier electric drive was developed due to the number of advantages over other types of electric drives. The possibility for designing a compact engine reveals the promise for developing a motor wheel of a multimotor modification which will make it possible to improve the flexibility of the control and the reliability of the drive of an electric automobile. The basic technical requirements determined by the specifics of designing and developing a motor are: high ratios of torque when accelerating and climbing, high efficiency in a wide rpm range and limited weight and size with minimal possibilities for cooling and rigid operating conditions. The use of high energy permanent magnets made of rare earth elements made it possible to develop a motor which provides the required operating modes and performance at the required size. The design of a developed motor is discussed. DOE

N81-13812# CONSAD Research Corp., Pittsburgh, Pa.

METHODOLOGY FOR THE EVALUATION OF THE URBAN TECHNOLOGY SYSTEM. EXECUTIVE SUMMARY

Samuel I. Doctors Dec. 1979 37 p

(Grant NSF ISP-78-27101)

(PB80-209950; NSF/RA-800108) Avail: NTIS HC A03/MF A01 CSCL 05A

The methodology for an evaluation of an urban technology development system (UTS) is described which would: (1) assess to what extent, how, and why the original objectives of the UTS system were achieved; (2) provide policy relevant information to a variety of audiences to help them decide whether or not to participate in, or otherwise support, the UTS or similar systems; and (3) provide information to existing UTS participants to help them strengthen their operations. The sources used for evaluation data are itemized as are products of the evaluation. Resource requirements and scheduling are indicated. Procedures for addressing potential problems cover questions on representatives of test and control sites, loss of data through turnover and lack of documentation, nonresponding governments and organizations, and minimizing the respondent load. GRA

N81-13813# CONSAD Research Corp., Pittsburgh, Pa.

EVALUATION OF THE EXPERIMENTAL PHASE OF THE URBAN TECHNOLOGY SYSTEM. WORKING ANNOTATED BIBLIOGRAPHY

Jan. 1980 27 p

(Grant NSF ISP-78-27101)

(PB80-208283; NSF/RA-800112) Avail: NTIS HC A03/MF A01 CSCL 05B

The bibliography of publications pertinent to the Urban Technology System (UTS) comprises two parts: articles in journals and other collections, and books and monographs. Items are listed alphabetically by author, and each includes an abstract. UTS was designed to promote technological innovation in cities and urban counties with populations of 50,000-500,000, and case studies of innovation in participating sites. UTS involved assigning a Technology Agent to a city manager, mayor, or

equivalent county official to provide expertise to help solve a variety of public problems. The expertise was scientific or technological and involved managerial, administrative planning, or analytical skills. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N81-13814 California Univ., Davis.
A NUMERICAL STUDY OF ROTATING INTERSTELLAR CLOUDS: EQUILIBRIUM AND COLLAPSE Ph.D. Thesis
Michael Lester Norman 1980 229 p
Avail: Univ. Microfilms Order No. 8027075

A two dimensional hydrodynamics code was developed for an idealized interstellar gas cloud. The equilibrium structure of the cloud in contact with a constant intercloud pressure (the rotating analog of the Bonner-Ebert sphere) was computed. Parameter space was searched by slowly cooling equilibrium cloud of fixed mass, angular momentum, and distribution of angular momentum in a fixed external pressure. Spheroidal and toroidal equilibria were found, depending on the distribution of angular momentum. Cooling sequences ended in collapse. The critical line for collapse of spheroids with the angular momentum distribution of uniform rigidly rotating spheres of different angular momenta was found empirically. Isothermal collapse was calculated for a variety of initial and boundary conditions. Depending on the distribution of angular momentum, either a ring forms or collapse continues to very high central densities preserving the disk topology of the cloud. Dissert. Abstr.

N81-13815 Yale Univ., New Haven, Conn.
AN INVESTIGATION OF ABUNDANCE GRADIENTS WITHIN GALACTIC GLOBULAR CLUSTERS Ph.D. Thesis
Horace Alden Smith 1980 144 p
Avail: Univ. Microfilms Order No. 8026656

High spatial resolution integrated spectra were obtained for four southern clusters: 47 Tucanae Omega Centauri, NGC 1851, and NGC 6624. Only for 47 Tucanae was significant evidence for an abundance gradient found, the core of the cluster possibly being slightly metal rich relative to the halo Indirect evidence for cluster abundance gradients was sought in previously published star counts and photometry for annuli at differing radii from globular cluster centers. A review of the literature revealed that, with the possible exception of 47 Tucanae, existing data provide only weak evidence for abundance gradients. New star counts and BV iris photometry were obtained for annuli in Omega Centauri, with the result that little evidence was found supporting the existence of an abundance gradient. It was concluded that, while radial abundance gradients may exist in a few clusters, such is not generally the case. Dissert. Abstr.

N81-13816*# National Aeronautics and Space Administration, Washington, D. C.
THE CREATIVITY OF EINSTEIN AND ASTRONOMY
Ya. B. Zeldovich Jun. 1980 16 p Transl. into ENGLISH of "Tvorchestvo Einshteyna i Astronomiya", Rept. PR-451, Acad. of Sci., Moscow, 1979 p 1-14
(Contract NASw-3198)
(NASA-TM-76227) Avail: NTIS HC A02/MF A01 CSCL 03A

A discussion of Einstein's scientific achievements for the 100th anniversary of his birth is presented. His works dealing with thermodynamics are described, along with his quantum theory of radiation. Most of the article discusses his general theory of relativity. Author

N81-13817# European Space Agency, Paris (France). Space Science Dept.
THE SECOND EUROPEAN INTERNATIONAL ULTRAVIOLET EXPLORER (IUE) CONFERENCE
Bruce Battrick, comp. and Jacqui Mort, comp. Apr. 1980 448 p refs Proceedings of ESA/Tuebingen Univ. Intern. Conf., Tuebingen, West Germany, 26-28 Mar. 1980 Cosponsored by Deut. Forchungsgemeinschaft Prepared in cooperation with Tuebingen Univ., West Germany
(ESA-SP-157) Avail: NTIS HC A19/MF A01

Topics include ultraviolet studies of comets, supernovae, Magellanic cloud stars, quasars, the solar system, and the interstellar medium. Other subjects are: Ap stars, Rs CVn stars, mass loss, stellar chromospheres and novae, IUE data analysis, emission line stars, X-ray sources, interstellar gas, planetary nebulae and H II regions. Also discussed are T Tauri stars, binaries with hot companions, Wolf-Rayet stars and extragalactic objects, subdwarf OB stars, He-rich stars, white dwarfs and neutron stars. For individual titles, see N81-13818 through N81-13901.

N81-13818*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ULTRAVIOLET SPECTROSCOPY OF COMETS
J. Rahe *In* ESA 2nd European IUE Conf. Apr. 1980 12 p refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

The UV spectra of a comet, Comet Seargent 1978m, were obtained two weeks after the comet's discovery before any ground-based spectroscopic observations were made. The second comet observed with IUE was Comet Bradfield 1979e. It was first observed on January 10 and 11, 1980, and subsequently on several occasions until the beginning of March of 1980. The comets were observed at various heliocentric distances in the low and high dispersion mode. In the long wavelength region, emission bands of OH, CS, CO2(+), NH and CO(+) were identified, and the rotational structures of the (0, 0) and (1, 0) bands of OH were resolved. In the short wavelength region, emission lines of H(L alpha), O I, C I, C II, and C 1 and the CO fourth positive bands appeared. The results of these observations are the detection of S I; indications that CS exists as 'Parent Molecules' in the cometary ice; the resolution of the (0, 0) and (1, 0) bands of OH; the determination of the spatial variations of various emissions; the determination of the variation of the production rates of various species, especially of H and OH, with heliocentric distance. Author (ESA)

N81-13819# Consiglio Nazionale delle Ricerche, Bologna (Italy). Ist. di Radioastronomica.
OBSERVATIONS OF SUPERNOVAE
N. Panagia *In* ESA 2nd European IUE Conf. Apr. 1980 5 p refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

The International Ultraviolet Explorer (IUE) observations of supernova 1979c in the galaxy M100 are discussed in some detail. The findings for SN 1979c are: the bulk of the energy is in the form of continuous emission which is radiated by the main SN envelope. The absorption features originate mostly in both the disks and the haloes of our Galaxy and M 100. The emission lines are produced in a highly ionized shell which has a radius greater than twice the radius of the main envelope and consists of compressed circumstellar material in which the abundance ratio N/C is about 30 times higher than solar.
Author (ESA)

N81-13820# Kiel Univ. (West Germany). Inst. fuer Theoretische Physik und Sternwarte.
MASS LOSS AND CORONAE OF COOL STARS
D. Reimers *In* ESA 2nd European IUE Conf. Apr. 1980 6 p refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

Current knowledge about the occurence of coronae and mass loss in cool stars was reviewed. Observational arguments are advanced, stating that both mass loss phenomena and coronae around cool stars vary in a continuous way from solar-type stars via G and K giants to luminous M supergiants. It is pointed out

that IUE observations of cool giants with hot companions are important: the absolute scale of mass loss in red giants can be established more accurately by observing circumstellar lines in the UV spectra of companions; nonclose binary companions with rotating disks, formed by accretion from stellar winds of red giants, may serve to study the formation and structure of accretion disks under well defined conditions. Author (ESA)

N81-13821# Cambridge Univ. (England). Inst. of Astronomy.
DWARF NOVAE
J. A. J. Whelan *In* ESA 2nd European IUE Conf. Apr. 1980 8 p refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

An outline is given of a long-term program to study dwarf novae spectra at ultraviolet and optical wavelengths. Optical and ultraviolet spectrophotometry were obtained for the following dwarf novae: VW Hyi, WX Hyi, Z Cha, BV Cen, EX Hya, and V436 Cen. Results show that some of the continuum spectra show agreement with steady disc models. Also, the temperatures estimated from the turnover or absence of turnover at short wavelengths indicate inner disc temperatures up to at least 80,000 K. The fraction of the accretion luminosity emitted in the visible wavelength range is of order a few percent, simplying a large bolometric correction. In addition, for a given dwarf nova the continuum slope rises more steeply towards the ultraviolet as the brightness increases, implying that during the outburst the disc is hotter and that the bolometric correction changes. No 2200A feature is seen indicating very little interstellar reddening. The main spectral lines seen in the ultraviolet include N V, O I, C II, Si IV, C IV, He II, Al III, and Mg II. Author (ESA)

N81-13822# Eidgenoessische Technische Hochschule, Zurich (Switzerland). Atomic Physics and Astrophysics Group.
INTERNATIONAL ULTRAVIOLET EXPLORER (IUE) OBSERVATIONS OF PLANETARY NEBULAE
H. Nussbaumer *In* ESA 2nd European IUE Conf. Apr. 1980 6 p refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

Observations of more than 50 planetary Nebulae (PN) were reviewed. International Ultraviolet Explorer (IUE) spectra allow the observations of lambda lambda 1335, 2326 of C II, lambda 1908 of C III, and lambda 1549 of C IV, as well as many recombination lines of these ions. All PN were found to show N/O enrichment, and most show a C/O ratio larger than the sun. The O/H ratios studied varied from close to solar values to eight times less than the solar ratio. Electron densities were measured for NGC 6210 and NGC 7009. IUE observations of CO in PN showed values than radio measurements. Mass losses were determined for general central stars in PN. Use of IUE observation for studying the formation of PN is discussed. Author (ESA)

N81-13823# University Coll., London (England). Dept. of Physics and Astronomy.
ULTRAVIOLET OBSERVATIONS AND THE NATURE OF THE WOLF-RAYET STARS
A. J. Willis *In* ESA 2nd European IUE Conf. Apr. 1980 9 p refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

Ultraviolet observations of Wolf-Rayet (WR) stars obtained prior to and with International Ultraviolet Explorer (IUE) were reviewed. The IUE data allow accurate interstellar reddening corrections and color temperatures to be determined for a large sample of stars. WR stellar wind terminal velocities show a strong correlation with WN subclass in both galactic and LMC stars. A revised mass loss rate scale for WR stars is discussed. Values of dM/dt for WR stars are much greater than the limit L/V infinity C, indicating a mechanism other than radiation pressure drives the mass loss. Current ideas concerning the chemistry and evolutionary status of the WR stars are addressed. Author (ESA)

N81-13824# Amsterdam Univ. (Netherlands). Inst. of Astronomy.
INTERNATIONAL ULTRAVIOLET EXPLORER (IUE) OBSERVATIONS OF X-RAY BINARIES
G. Hammershlag-Hensberge *In* ESA 2nd European IUE Conf. Apr. 1980 7 p refs Sponsored by Netherlands Organization for the Advancement of Pure Research (ZWO) (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

Most early type X-ray binaries show continuum and line variations which are correlated with binary phase. High dispersion spectra of the X-ray binary HD 77581/Vela X-1 provide a unique opportunity to study the ionization structure of the stellar wind under the influence of the X-ray source. These results were compared with the line profile variations of Si IV and C IV in low resolution spectra obtained for three other early type X-ray binaries. It is shown that the intensity of the X-ray source and the density of the stellar wind strongly influence the observed line variations. UV observations of three low mass X ray binaries which were observed with IUE: Sco X-1, Her X-1 and AM Her are discussed. Author (ESA)

N81-13825# European Southern Observatory, Geneva (Switzerland).
OBSERVATIONS OF NGC 4151 WITH INTERNATIONAL ULTRAVIOLET EXPLORER (IUE)
A. Boksenberg (University Coll., London), G.E. Bromage (Science Research Council, Chilton, England), J. Clavel (ESA, Madrid), A. Oyelvius (Stockholm Observatory), A. H. Gabriel (Science Research Council, Chilton, England), P.M. Gondhalekar (Science Research Council, Slough, England), C. Jordan (Oxford Univ.), J. Lind (Lund Univ., Sweden), J. Lindegren (Lund Univ., Sweden), M. Longair (Cambridge Univ., England) et al *In* ESA 2nd European IUE Conf. Apr. 1980 4 p refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

The star NGC 4151 was observed with International Ultraviolet Explorer at six different epochs between May and January 1979. Complex spectral variations were found. The variations of the UV continuum which were observed are slower and have smaller amplitudes than the Ariel V satellite. The emission lines are those normally seen in quasar spectra; the intensities and profiles of C IV and Si IV are variable. A number of absorption lines are present in the short wavelength spectra. The continuous spectrum from the infrared to lambda about 1700 A can be fitted fairly well with a power law spectrum F sub NU varies as NU - 1.2 power. A flatter component is present shortward of 1700 A. There is no evidence for absorption by dust near 2200 A. Author (ESA)

N81-13826# University Coll., London (England). Dept. of Physics and Astronomy.
ULTRAVIOLET OBSERVATIONS OF QUASARS
M. A. J. Snijders *In* ESA 2nd European IUE Conf. Apr. 1980 10 p refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

Observations of quasistellar objects (QSO) particularly for lambda less than 912A were reviewed. Also discussed are the covering factor of the central source, the hydrogen emission line formation problem and the possibility of extinction in and along the line of sight towards QSOs, as well as the sources of the narrow absorption lines seen in many QSO spectra. A definite source of narrow absorption lines is interstellar material both in our own Galaxy, especially the halo, and intervening galaxies along the line of sight towards the QSOs: for nearby sources: Mk 205, 3c273 and 3c232, this can account for at least the great majority of observed narrow absorption lines. However in high redshift QSOs like 1225+310 the line density is much higher, predominantly shortward of emission Lyman alpha both in the optical and long wavelength IUE data. Author (ESA)

N81-13827# Bonn Univ. (West Germany). Physikalisches Inst.
AN EVALUATION OF THE SKY LYMAN ALPHA EMISSION IN INTERNATIONAL ULTRAVIOLET EXPLORER (IUE) SPECTRA
K. H. Fricke and O. Ojanguren (ESA, Madrid) *In* ESA 2nd European IUE Conf. Apr. 1980 p 3-6 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

An emission line at 1216 A is noticeable in International Ultraviolet Explorer spectra for exposure times longer than about 5 minutes in low dispersion. For a set of seven sky-only spectra the expected Lyman alpha column emission rate was calculated

from standard models of geocoronal and interplanetary hydrogen. The geocorona contributes between 5% and 50% of the signal, depending on the observing geometry. The calculated emission rates are higher than the observed ones by approximately 19% with a scatter of 11%. This discrepancy is smaller than the combined errors of observation and calculation. Author (ESA)

N81-13828# Observatoire de Paris-Meudon (France).
VERTICAL DISTRIBUTION OF NH3 IN THE UPPER JOVIAN ATMOSPHERE FROM INTERNATIONAL ULTRAVIOLET EXPLORER (IUE) OBSERVATIONS
M. Combes, T. Encrenaz, and K. H. Fricke (Bonn. Univ.) *In* ESA 2nd European IUE Conf. Apr. 1980 p 7-9 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

Ammonia was identified in the upper atmosphere of Jupiter from the observation of individual NH3 bands between 2000 and 2300 A, on a International Ultraviolet Explorer (IUE) high resolution spectrum. The shape of these NH3 bands implies that the ammonia distribution must be strongly reduced by photolysis in the upper Jovian atmosphere. Author (ESA)

N81-13829# Groningen Rijksuniversiteit (Netherlands). Kapteyn Astronomical Inst.
ABUNDANCES AND PHYSICAL CONDITIONS IN A HIGH-VELOCITY CLOUD
S. R. Pottasch, P. R. Wesselius, and E. M. Arnal *In* ESA 2nd European IUE Conf. Apr. 1980 p 13-17 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

The physical conditions in the 'high-velocity cloud' in the direction of HD 175754 are discussed, based on the high-dispersion International Ultraviolet Explorer (IUE) measurements. It was found that the abundances are very close to solar. Although the oxygen (and presumably also the hydrogen) is mostly neutral, the ionization is higher than expected from a neutral cloud. Consequences for the ionization and heating of the interstellar medium in general are discussed. Author (ESA)

N81-13830# Groningen Rijksuniversiteit (Netherlands). Kapteyn Astronomical Inst.
OBSERVATIONS OF THE EXCITING STARS OF NGC 2023 AND M43: INTERSTELLAR EXTINCTION AND ABUNDANCES
D. P. Gilra, E. M. Arnal, P. R. Wesselius, S. R. Pottasch, and J. Devries *In* ESA 2nd European IUE Conf. Apr. 1980 p 19-20 refs Sponsored in part by Arg. Consejo Nacl. de Invest. Cient. y Tec. (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

Both low and high resolution International Ultraviolet Explorer (IUE) observations of the exciting stars of two nebulosities in Orion, NGC 2023 (HD 37903) and M43 (HD 37061) are discussed. Comparison with Astronomical Netherlands Satellite (ANS) observations shows that, in the 2.5 min X 2.5 min ANS field of view, a substantial nebular contribution is included. The extinction curve for HD 37903 is smilar to that of the inner region of the rho Oph cloud whereas for HD 37061 it is even lower throughout UV with the normalized extinction at 2200 being only 3.8. It appears that the ratio of small aperture to large aperture data is not wavelength independent in the long wavelength range. From the high resolution observations it seems that carbon may be less and oxygen may be more under/abundant in these directions. Author (ESA)

N81-13831# Observatoire de Paris (France).
ULTRAVIOLET OBSERVATIONS OF A BP-STAR AT HIGH GALACTIC LATITUDE
J. Berger, A. M. Fringant, M. Gerbaldi (Inst. d'Astrophysique, Paris), and N. Morguleff (Inst. d'Astrophysique, Paris) *In* ESA 2nd European IUE Conf. Apr. 1980 p 29-30 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

The high velocity metal-poor star HD 214 539 AOIB was analyzed for Mg II lines around 2800 A. It was possible to separate the interstellar components. According to predicted and observed correlation between the Mg II UV lines in supergiants as a function of spectral type of effective temperature, the predicted Mg II line intensity is at least 1 A. This suggests a great underabundance of Mg II in HD 214 539. Author (ESA)

N81-13832# Institut d'Astrophysique, Paris (France).
ULTRAVIOLET VARIATION OF THE AP STAR 21 COM
M. Gerbaldi, N. Morguleff, and C. Megessier (Observatoire de Paris) *In* ESA 2nd European IUE Conf. Apr. 1980 p 31-34 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

Low resolution UV spectra were taken in long and short wavelength regions covering one cycle of the star (period about one day). Large flux variations were found at wavelengths shorter than 2000 A, which vanish at longer wavelengths. High and low resolution spectra were compared to examine the possibility that 21 Com is an emission star, but results suggest that the observed flux maximum at lambda 1951 A is not due to an emission of Ca III as had been suggested. Author (ESA)

N81-13833# Technische Hochschule, Vienna (Austria). Inst. for Astronomy.
THE UV RESONANCE LINES OF HD 175362, A HELIUM VARIABLE WITH A STRONG MAGNETIC FIELD
K. D. Rakos *In* ESA 2nd European IUE Conf. Apr. 1980 p 35-37 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

High resolution spectra of the Ap stars HD 133029, HD 219749, HD 168733 and HD 175362 were obtained during two 16 hours shifts with the IUE satellite. The resonance lines of HD 175362 in particular show very peculiar behavior. Stellar wind, extended atmosphere in rigid corotation with the stellar surface and the influence of the strong magnetic field on the upper part of the atmosphere would explain the shape and the strength of the resonance lines. The necessary driving forces for the expanding envelope are not compatible with the diffusion on theory of the Ap atmospheres. Author (ESA)

N81-13834# Laboratorio di Astrofisica Spaziale, Frascati (Italy).
Fe II IN THE INTERNATIONAL ULTRAVIOLET EXPLORER (IUE) SPECTRA OF EMISSION LINE STARS
R. Viotti, A. Giangrande, O. Ricciardi, A. Altamore (Rome Univ.), A. Cassatella (ESA, Madrid), M. Freidjung (Inst. d'Astrophysique, Paris), and G. Muratorio (Observatoire de Marseille) *In* ESA 2nd European IUE Conf. Apr. 1980 p 39-41 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

The behavior of the Fe II lines in the ultraviolet spectra of the emission line stars Boss 1985, eta Car, and S 22 in the Large Magellanic Cloud was examined. The dependence of the Fe II line emission as a function of the excitation potential, line strength, and wavelength is discussed. Increased optical thickness of the emission lines, the presence of absorption components, and in many cases, a large negative continuum gradient make the study of Fe II in low resolution spectra more difficult. Author (ESA)

N81-13835# European Space Agency, Madrid (Spain). Astronomy Div.
SIMULTANEOUS SPECTROSCOPIC (UV Mg II AND Al II LINES) AND PHOTOMETRIC VARIATIONS OF ZETA 1 SCO (HD 152236)
A. Heck, G. Burki (Geneva Observatory), L. Bianchi, A. Cassatella, and J. Clavel *In its* 2nd European IUE Conf. Apr. 1980 p 43-46 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

Repeated IUE observations of zeta 1 Sco show variations in the line profiles of the two Mg II doublets at about 2800 A and of the Al II lambda 1670 line. A series of puffs in the expanding envelope was identified, implying a non-stationary mass loss process. A phase of particularly discontinuous loss of matter has been correlated with a sharp decrease of the V magnitude. Author (ESA)

N81-13836# Vrije Universiteit, Brussels (Belgium). Inst. of Astrophysics.
PULSATION OF THE OUTER ATMOSPHERE OF BW VUL
M. Burger and C. Dejager (Utrecht State Univ.) *In* ESA 2nd European IUE Conf. Apr. 1980 p 47-49 refs (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

Observations of the far UV spectrum of the beta Cephei variable BW Vul show that the pulsation consists of three phases: a phase of photospheric rest; a sudden upward acceleration of the photosphere and outer atmosphere (the maximum acceleration being approximately equal to the gravitational value); descent of the whole atmosphere with downward acceleration 1/4 of the gravitational value. At the end of the second phase a temporal stellar wind occurs with maximum velocity of 500 km s(-1).

Author (ESA)

N81-13837# European Space Research and Technology Center, Noordwijk (Netherlands). Space Science Dept.

MASS LOSS AND MASS TRANSFER IN THE BINARY STAR HD 41335

F. Paterson-Beeckmans *In* ESA 2nd European IUE Conf. Apr. 1980 p 51-54 refs (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

The Be star HD 41335, a prototype of an interacting binary, is discussed. International Ultraviolet Explorer high resolution spectra obtained at 5 different phases of the binary cycle show prominent variations due to the transfer of mass between the secondary and the primary star (B2V). Redshifted (V = +50 km/s) narrow lines are characteristics of the phase 0 (primary seen through the mass flow). Around phase 0.5, blueshifted shell lines (V = -65 km/s) indicate a mass flow through the external Lagrangian point. The Al 3 (1), Si 4 (1), C4 (1), Fe 3 (34, 38) multiplets present at all the phases strong and asymmetric absorption features, with outward velocities up to 550 km/s (C4), larger than the escape velocity for this rapidity rotating star (v sin i + 415 km/s). Author (ESA)

N81-13838# Catania Astrophysical Observatory (Italy).

CHROMOSPHERIC PLAGES ON II PEGASI (HD 224085)

M. Rodono, G. Romeo, and G. Strazzulla *In* ESA 2nd European IUE Conf. Apr. 1980 p 55-57 refs (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

Low resolution International Ultraviolet Explorer spectra in the long wavelength region of II Peg which were obtained in July 1979 simultaneously with ground-based UBV observations are presented. Light curves are presented which show variations in amplitude in the range from 0.10 to 0.30. H and K line blending for Mg II in emission was noted. Author (ESA)

N81-13839# Laboratorio di Astrofisica Spaziale, Frascati (Italy).

SIMULTANEOUS UV AND OPTICAL OBSERVATIONS OF SIGMA G AN RS CVN-LIKE STAR: PRELIMINARY RESULTS

F. Giovannelli, A. Giangrande, S. M. Rucinski (Warsaw Univ.), C. Bartolini (Bologna Univ.), A. Guarnieri (Bologna Univ.), A. Piccioni (Bologna Univ.), S. Guadenzi (Rome Univ.), and C. Rossi *In* ESA 2nd European IUE Conf. Apr. 1980 p 59-60 refs (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

Some UV spectra of sigma Gem are discussed. The ground-based observations include medium dispersion (40 A/mm) optical spectra and UBV photoelectric photometry. The binary system belongs to the long-period group. The width at the base of the K line of Mg II was found to correspond to 430 + or - 20 km/s, implying a value Msubv=-4.9 + or - 0.3. This improbably large luminosity for a Ki III star indicates that the Weiler-Oegele relation does not work in this case. The short wavelength low resolution International Ultraviolet Explorer spectra show the strong activity of the system. The long wavelength spectrum shows only the resolved Mg doublet and a trace of rising continuum at the long wavelength end. Ground based UBV data are in agreement with other observations.

Author (ESA)

N81-13840# Catania Astrophysical Observatory (Italy).

THE CHROMOSPHERE OF THE A7V STAR ALPHA (Aql)+

C. Blanco, S. Catalano, and E. Marilli *In* ESA 2nd European IUE Conf. Apr. 1980 p 63-66 refs (For primary document see N81-13817 04-89)

(Contract CNR-78-01440.02)

Avail: NTIS HC A19/MF A01

High resolution spectrograms of alpha Aql (A7V) obtained with the International Ultraviolet Explorer (IUE) satellite in the short and long wavelength regions were taken. Evidence of chromospheric emission in the h and k lines of Mg II was found. The width delta lambda approximately equals 1.4 A fits very closely the linear relationship between the absolute visual magnitude and Mg II emission width. Hydrogen L alpha emission was detected and a flux of 5.58 + or - 1.0 x 100,000 ERG/sq cm sec at the stellar surface was estimated. Author (ESA)

N81-13841# Uppsala Ionospheric Observatory (Sweden).

CHROMOSPHERES AND TRANSITION REGIONS IN F DWARFS

M. Saxner *In* ESA 2nd European IUE Conf. Apr. 1980 p 67-70 refs (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

Low resolution spectra in the wavelength region 1150-1000 A were obtained for five F stars using the SWP camera on the International Ultraviolet Explorer satellite. In four of these spectra emission lines from O I, C II, Si IV, and N V are visible. These lines are also prominent in the UV spectra of the quiet sun and cooler stars with chromospheric activity. The lines, with the exception of the O I line, originate in a transition region between the chromosphere and the corona. It was found that the surface flux in the emission lines of the stars observed is comparable to that in late type stars with chromopheric activity.

Author (ESA)

N81-13842# Oxford Univ. (England). Dept. of Theoretical Physics.

THE CHROMOSPHERIC AND CORONAL STRUCTURE OF ALPHA CMi (F5 IV-V)

A. Brown and C. Jordan *In* ESA 2nd European IUE Conf. Apr. 1980 p 71-75 refs Sponsored by UK Science Research Council (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

Observations of alpha CMi (Procyon) obtained with the International Ultraviolet Explorer satellite were analyzed to determine the structure of the outer atmosphere. This analysis is used to examine the terms of the energy balance equation. Radiation losses exceed those from comparable regions of the solar atmosphere and dominate the energy balance of the atmosphere. The coronal temperature and pressure are 300,000 K and 2 X 10 to the 14th power cu/cm K. Line profiles from high resolution spectra are used to determine the nonthermal energy flux. Comparisons made between the required energy input and that expected from heating by acoustic waves show that, from observations and models, energy deposition by acoustic waves should be sufficient to account for the radiative losses. Author (ESA)

N81-13843# Kiel Univ. (West Germany). Inst. fuer Theoretische Physik und Sternwarte.

THE ACTIVE CHROMOSPHERE AND CORONA OF HD 4502 (ZETA AND)

D. Reimers *In* ESA 2nd European IUE Conf. Apr. 1980 p 77-79 refs (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

Low resolution International Ultraviolet Explorer spectra covering the range 1200 to 3200 A show that the binary zeta And (K 2II) has an emission line spectrum of chromospheric and transition layer lines similar to that observed in stars like lambda And and HR 1099. The underlying continuum flux between 1600 A and 3000 A is due to the K giant. Also in the UV the companion is not visible. The UV lines are typically an order of magnitude stronger than in the otherwise similar lambda and spectrum which indicates that there is more coronal material with T=200,000 K. Si IV 1402/C III 1909 and Si III 1892/C III 1909 ratios yield a transition layer pressure log Ne. T sub e=15.5. Author (ESA)

N81-13844# Bonn Univ. (West Germany). Observatorium Hoher List.

GROUND BASED AND UV OBSERVATIONS OF THE SPOT AND CHROMOSPHERIC ACTIVITY OF THE SHORT PERIOD ECLIPSING BINARY XY URSAE MAJORIS

E. H. Geyer and M. Hoffman *In* ESA 2nd European IUE Conf. Apr. 1980 p 81-84 refs Sponsored in part by Deut.

Forschungsgemeinschaft (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

Six long wave low resolution International Ultraviolet Explorer spectrograms obtained of the spotted eclipsing binary XY UMa are discussed. They show a strong chromospheric continuum rising from lambda lambda 240 nm to lambda 310 nm. On it are superimposed a large number of emission, and a few absorption features. The most prominent ones are those of the Mg 2 resonance doublet and of Fe 2 emission line blends. Both the continuum and the emission features show orbital phase dependent variations. The comparison with early simultaneous optical photometric and spectroscopic observations exhibits the interaction of the photospheric and chromospheric activity, the latter of which is much enhanced whenever the optical light curve shows depressions. Author (ESA)

N81-13845# Centre National de la Recherche Scientifique, Paris (France). Inst. d'Astrophysique.
THE UV SPECTRUM OF WZ Sge AT NOVA MAXIUM
M. Friedjung, B. Rocca-Volmerange (Paris XI Univ.), and G. Debeve *In* ESA 2nd European IUE Conf. Apr. 1980 p 85-86 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

Profiles of relatively unblended lines on a short wavelength region high dispersion spectrum, were measured. Both line absorption and line emission are seen. The former is stellar and not interstellar. The profiles were classified, and their regions of formation are considered. The C 4 resonance blend can be understood as consisting of emission components having a similar profile to that of the He 2 1640 A, and black absorption lines. The form of the He 2 1640 A profile suggests moreover the existence of an outer excretion disk, in addition to the well-known accretion disk. Author (ESA)

N81-13846# Observatoire de Paris-Meudon (France).
THE UV SPECTRA OF TWO OLD NOVAE (HR DEL AND V 603 Aql)
D. Dultzin-Hacyan, Y. Andrillat (Observatoire de Haute Provence, France), J. Audouze (CNRS, Paris), M. Friedjung (CNRS, Paris), C. Gordon (Paris VI Univ.), B. Rocca-Volmerange (CNRS, Paris), and G. Stasinka *In* ESA 2nd European IUE Conf. Apr. 1980 p 87-89 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

Two old novae observed by the International Ultraviolet Explorer (short and long wavelength regions) are discussed. Reddening was evaluated by the disappearance of the absorption feature at 2200 A. This determination permitted the evaluation of the UV fluxes and the fitting of the HR Dephini flux to an approximate 40,000 K blackbody curve and a power law for far UV wavelength. V 603 Aql is better fitted by two blackbody curves of about 50,000 K and 8000 K for far UV wavelengths. An evaluation of the total emitted energy is given. A P Cygni profile was found for the C 4 doublet in the HR Del spectrum and allows the determination of a minimum mass loss rate and provides some information on the nature of the stellar wind.
Author (ESA)

N81-13847# Bonn Univ. (West Germany). Observatorium Hofer List.
NOVAE AND RELATED STARS AT QUIESCENCE
H. W. Duerbeck, G. Klare (Landessternwarte auf dem Koenigstuhl), J. Krautter (Landessternwarte auf em Koenigstuhl), B. Wolf (Landessternwarte auf dem Koenigstuhl), W. C. Seitter (Muenster Univ., West Germany), and W. Wargau (Remeis Sternwarte) *In* ESA 2nd European IUE Conf. Apr. 1980 p 91-94 refs (For primary document see N81-13817 04-89)
(Contract DFG-Du-104/2)
Avail: NTIS HC A19/MF A01

UV spectra of the novae V603 Aql, HR Del, RR Pic, the recurrent nova T CrB, the dwarf nova RU Peg and the novalike variable TT Ari were taken, and interstellar extinction values, temperatures and sizes were derived. The spectroscopuic appearance of the novae, the recurrent nova and the dwarf nova in the UV was not unlike that of the X-ray binary HZ Her, which consisted of an F-type main sequence star and a compact companion surrounded by an accretion disk. It was assumed that the continuum and the emission lines observed in the UV spectra of the cataclysmic variables are due to line radiation emitted from the optically thick parts of an accretion disk or shell surrounding a star of small size. The observed temperature distribution in the optically thick parts of the accretion disks was similar to that of theoretical disk models. Author (ESA)

N81-13848# Osservatorio Astronomico, Trieste (Italy).
PARASITE LIGHT EFFECTS IN INTERNATIONAL ULTRAVIOLET EXPLORER (IUE) LOW RESOLUTION SPECTRA
L. Crivellari and C. Morossi *In* ESA 2nd European IUE Conf. Apr. 1980 p 99-102 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

Procedures were developed for extracting low resolution spectra while correcting for halation effects and scattered light within the instrument. To correct for halation, the spectra were extracted from the line-by-line images. Perpendicular scans of the image were fitted using an iterative least squares procedure with a known form function. The fitting function was a linear combination of a Gaussian with a Lorentz function. Correction for light scattered from the gratings employed a guess and test method. A priori choices of schematic spectral distributions were used to compute different sets of scattered light coefficients. Satisfactory results are shown for both methods. Author (ESA)

N81-13849# Centre National de la Recherche Scientifique, Verrieres-le-Buisson (France). Lab. de Physique Stellaire et Planetaire.
AN IMPROVED INTERNATIONAL ULTRAVIOLET EXPLORER (IUE) IMAGE PROCESSING SYSTEM. THE CASE OF ABSORPTION LINES IN HIGH DISPERSION SPECTRA
C. Laurent, A. Vidal-Madjar, and J. Paul (Centre d'Etudes Nucleaires, Saclay, France) *In* ESA 2nd European IUE Conf. Apr. 1980 p 103-107 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

A correction procedure was developed for the problem of overestimated background correction where the echelle orders crowd together and for cosmic ray-induced spots which contribute to the observed intensity or to the background. The raw data matrix was rotated 45 deg to have the interference orders mostly parallel to the columns of the matrix. A step by step determination was then made of both background profile and intensity profile across the orders. The method was applied to a 7 1/2 hour exposure spectrum of the SMC star S-159. An improvement in background correction was noted, as well as a net gain in spectral resolution. Author (ESA)

N81-13850# European Space Agency, Madrid (Spain). Villafranca Satellite Tracking Station.
HIGH VELOCITY GAS ASSOCIATED WITH SUPERNOVA REMNANTS
P. M. Gondhalekar and A. P. Phillips (University Coll., London) *In its* 2nd European IUE Conf. Apr. 1980 p 109-113 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

High dispersion International Ultraviolet Explorer spectra of early type background stars were obtained. An analysis was made of absorption lines originating in gas associated with the remnant S147 and the detection of gas associated with the remnant IC443. In the star HD 36665 behind S147, high velocity lines and low velocity interstellar CO was detected, probably originating in gas associated with the remnant. Author (ESA)

N81-13851# Queens Univ., Belfast (Northern Ireland). Dept. of Pure and Applied Physics.
OBSERVATIONS OF HIGH VELOCITY COMPONENTS
D. Giaretta, B. Bates, R. E. L. Bankhead, W. Brown-Kerr, and J. A. McQuoid *In* ESA 2nd European IUE Conf. Apr. 1980 p 115-118 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

The stars HD 175754, HD 1976, HD 212978, and HD 225094 were observed with International Ultraviolet Explorer at high despersion. A summary of earlier data is presented along with the UV observations. These are discussed in models in which it is assumed that the gas is a homogeneous slab that is either photoionized by UV radiation, or thermally ionized. Similarities among the high velocity components (HVC) in three

of the stars and their densities indicate that they could be thin along the line of site. Author (ESA)

N81-13852# European Space Agency, Noordwikj (Netherlands). Astronomy Div.

COORDINATED GROUND-BASED AND INTERNATIONAL ULTRAVIOLET EXPLORER (IUE) OBSERVATIONS OF HOT STARS IN THE MAGELLANIC CLOUDS

F. Macchetto, P. Benvenuti (ESA, Madrid), S. DOdorico (European Southern Observatory, Geneva), and N. Panagia (Bologna Univ.) *In its 2nd European IUE Conf. Apr. 1980 p 119-122 refs* (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

Ground based and International Ultraviolet Explorer (IUE) observations of hot stars in the Large and Small Magellanic Clouds were carried out to investigate the mass loss process in these objects and to search for differences with galactic hot stars. Results show that in a large proportion of the stars observed the mass loss process is taking place. A mechanism for acceleration of the wind in OB stars is proposed, involving multiple scattering of hard UB photons in the range 100A to 500A. *Author (ESA)*

N81-13853# Science Research Council, Slough (England).

***HIGH RESOLUTION OBSERVATIONS OF INTERSTELLAR* LINES IN THE INTERNATIONAL ULTRAVIOLET EXPLORER (IUE) SPECTRA OF LARGE MAGELLANIC CLOUD (LMC) STARS**

P. M. Gondhalekar, A. J. Willis (University Coll., London), D. H. Morgan (Royal Observatory, Edinburgh), and K. Nandy *In* ESA 2nd European IUE Conf. Apr. 1980 p 123-127 refs (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

Velocity profiles of numerous interstellar lines observed in large high resolution International Ultraviolet Explorer (IUE) spectra of several stars in the Large Magellanic Cloud (LMC) are discussed. In all lines of sight, well defined velocity components are seen similar to those reported for the Ca2 k interstellar line observed in the spectrum of HD 38268. Author (ESA)

N81-13854# Science Research Council, Slough (England).

ULTRAVIOLET SPECTRA OF EXTRAGALACTIC H II REGIONS

P. M. Gondhalekar, D. H. Morgan (Royal Observatory, Edinburgh), K. Nandy (Royal Observatory, Edinburgh), and R. Wilson (University Coll., London) *In* ESA 2nd European IUE Conf. Apr. 1980 p 131-132 refs (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

H2 regions in the galaxies NGC 2366 and IC 2574 were observed wit the International Ultraviolet Explorer (IUE) at low resolution. The spectra show the 2200A absorption feature and many emission lines. The spectrum of each of the H2 regions, when smoothed into 10A wavelength intervals, shows two broad depressions centered at 2175A and 1685A. It was not possible to identify the latter further than to suggest that it may be caused by a conglomeration of absorption lines of the iron group of elements in various stages of ionization. The line spectra show many absorption lines as well as collisionally excited forbidden and semiforbidden emission lines. The spectrum of NGC 2366 is dominated by emission lines the strongest being C3. The emission spectrum of IC 2574 is very weak, suggesting that the ionizing photons arise from stars cooler than those ionizing NGC 2366. Electron densities were computed: 20 per cu cm for NGC 2366 and 15 per cu cm for IC 2574.

Author (ESA)

N81-13855# Cambridge Univ. (England). Inst. of Astronomy.

ULTRAVIOLET SPECTRUM OF DWARF BLUE GALAXY TOLOLO 1924-416 (z = 0.0096)

R. F. Carswell, P. M. Gondhalekar (Science Research Council, Slough, England), D. H. Morgan (Royal Observatory, Edinburgh), K. Nandy (Royal Observatory, Edinburgh), and R. Wilson (University Coll., London) *In* ESA 2nd European IUE Conf. Apr. 1980 p 133-134 refs (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

The ultraviolet spectrum of the dwarf blue galaxy Tololo 1924-416 was obtained with the International Ultraviolet Explorer. The spectrum has a strong 2200 A absorption feature and the color excess obtained from the 2200 A feature (assuming the galactic extinction law) and that obtained from the Balmer decrement are similar. The stellar composition of the gas in the galaxy described. The L alpha/H beta ratio in the dereddened spectrum was found to be normal. Author (ESA)

N81-13856# Ruhr Univ., Bochum (West Germany). Astronomisches Inst.

STELLAR WINDS IN BE STARS

J. Dachs *In* ESA 2nd European IUE Conf. Apr. 1980 p 139-142 refs (For primary document see N81-13817 04-89)

(Contract DFG-Da-75/6)

HC A19/MF A01

High-dispersion International Ultraviolet Exploser (IUE) spectrograms were obtained for eight bright early-type Be and shell stars. Indications for stellar winds were found in all program stars from asymmetric or violet-shifted ultraviolet resonance line profiles. The strongest wind velocities were observed for rho Car. The maximum velocities derived for rho Car from the violet edges of the C 4 and Si 4 resonance lines (-700 to -1100 km/sec) approximately corresponded to the wind velocity measured from the extension of the wings of emission in the H alpha line profiles found one year earlier (900 km/s). Emission appeared to be present only for part of the stars and only in the Fe2 and Mg2 resonance lines. Author (ESA)

N81-13857# Observatoire de Paris (France).

***T SUB e* STRUCTURE OF THE WIND IN GAMMA CAS**

V. Doazan, P. L. Selvelli (Osservatorio Astronomico, Trieste), R. Stalio (Osservatorio Astronomico, Trieste), and R. N. Thomas (Inst. d'Astrophysique, Paris) *In* ESA 2nd European IUE Conf. Apr. 1980 P 145-146 refs (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

UV observations of the wind in gamma Cas, via measure of line displacements, delineate two distinct and nonoverlapping velocity regions where absorbing ions for Si4, C4, N5 are concentrated at about 100 km/sec and 1400 km/sec. Absence of appreciable numbers of these ions absorbing at intermediate velocities suggests the presence of a corona too hot to support such ions in those atmospheric regions where such velocities occur; observed soft X-ray emission at coronal intensities from gamma Cas supports this picture. Visual studies show that the present phase of gamma Cas is moderately strong Be, and not B-shell. This Be-phase UB velocity behavior is contrasted with the present, rising from quasi B-normal, toward Be, phase behavior of 59 Cyg, where only the high velocity regime is observed in superionized species, and only the low velocity regime in photospheric Si4. Author (ESA)

N81-13858# Amsterdam Univ. (Netherlands). Inst. of Astronomy.

LONG TERM CHANGES IN ULTRAVIOLET RESONANCE LINES IN GAMMA CAS

H. F. Heinrichs, G. Hammerschlag-Hensberge, and H. J. G. L. M. Lamers (Astronomical Inst., Utrecht) *In* ESA 2nd European IUE Conf. Apr. 1980 p 147-149 refs Sponsored in part by Netherlands Organization for the Advancement of Pure Research (ZWO) (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

High resolution ultraviolet spectra of the B 0.5 IVe star gamma Cas, obtained with International Ultraviolet Explorer (IUE) show spectacular changes in the profiles of the resonance doublets of C4, N5 and Si4. In addition to the broad assymetric low velocity absorption lines which seem to be always present, narrow, blue-shifted absorption components, with velocities up to 1500 km/s were observed on 4 occasions. The time dependent high velocity features are interpreted in terms of spherical high density shells, which travel outwards with a terminal velocity not exceeding 1500 km/s. To explain the origin of these shells intermittent enhancementof the stellar wind mass loss rate (duration tau = 1 day, enhancement factor rno greater than 2) is proposed. It is predicted that the column density of the narrow lines will fade out, and the absorptions will last not longer than a few weeks. Earlier observations (by Copernicus) suggest that UB shells probably occur in all early type stars, independent of spectral class. In this respect, gamma Cas might be not unique. Author (ESA)

N81-13859# Observatoire de Paris (France).
VARIABLE WIND VELOCITY IN 59 CYG
V. Doazan, L. V. Kuhi (California Univ., Berkeley), J. M. Marlborough (Western Ontario Univ., Canada), T. P. Snow (Colorado Univ.), and R. N. Thomas (Inst. d'Astrophysique, Paris) *In* ESA 2nd European IUE Conf. Apr. 1980 p 151-154 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

Combined UV and visual observations of 59 Cyg in 1972, 1975, late 1978, and at several epochs in 1979 are summarized. Visual observations suggest a similar pattern of long term variability for 59 Cyg and gamma Cas, within which are placed the UV data on 59 Cyg. During the 1978-79 epoch of small but increasing H alpha emission, the C4 and N5 lines reached maximum expansion velocities of some 750 km/sec, whereas the Si4 lines showed neither appreciable displacements nor asymmetry. Line displacements of N5 varied by a factor 2, and appeared to oscillate, but line components that correspond to violet displacements 100 km/s were not identified. This 1978-79 situation is unlike the situation of strong Be phase of 59 Cyg in 1972 and 1975, and of Gamma Cas in 1978-79, where expansion at less than 100 km/s was observed. Author (ESA)

N81-13860# Osservatorio Astronomico, Trieste (Italy).
ULTRAVIOLET EMISSION LINE SPECTRUM OF PECULIAR STARS: HD 45677
P. L. Selvelli and R. Stalio *In* ESA 2nd European IUE Conf. Apr. 1980 p 155-157 refs Sponsored by CNR (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

International Ultraviolet Explorer high resolution spectra of HD 45677 were studied to analyze the complex atmospheric structure revealed by visible and infrared observations. The star has a rich spectrum of both emission and absorption lines. The ionic species range from neutral light elements like C, N and O, to Fe2, the dominant atomic spectrum, to superionized atoms like C4, Si4 which appear broad in absorption with composite structures. A tentative interpretation of the Fe2 and N spectra in terms of the Rosseland Theory of cycles, in presence of diluted radiation, is given. Author (ESA)

N81-13861# Laboratorio di Astrofisica Spaziale, Frascati (Italy).
SIMULTANEOUS ULTRAVIOLET AND OPTICAL OBSERVATIONS OF HDE 245770/A 0535+26
F. Giovannelli, M. Ferrari-Toniolo, A. Giangrande, P. Persi, C. Bartolini (Bologna Univ.), A. Guarnieri (Bologna Univ.), A. Piccioni (Bologna Univ.), and S. M. Rucinski (Warsaw Univ.) *In* ESA 2nd European IUE Conf. Apr. 1980 p 159-164 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

High and low dispersion UV spectra of HDE 245770, which is the optical counterpart of the recurrent transient X-ray pulsar A 0535+26 were obtained. UVB photometric measurements were simultaneously carried out and some medium dispersion optical spectra obtained close to the UV ones. A preliminary analysis of the UV spectra is given. Author (ESA)

N81-13862# Laboratorio di Astrofisica Spaziale, Frascati (Italy).
COORDINATED ULTRAVIOLET, OPTICAL AND INFRARED OBSERVATIONS OF CHI PER IN DECEMBER 1979: PRELIMINARY RESULTS
R. Viotti, M. Ferrari-Toniolo, A. Giangrande, P. Persi, L. Bianchi (ESA, Madrid), G. Grasdalen (Wyoming Univ.), P. Kalv (Tallin Observatory), and R. Stalio (Osservatorio Astronomico, Trieste, Italy) *In* ESA 2nd European IUE Conf. Apr. 1980 p 165-167 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

Coordinated ultraviolet, optical and infrared observations of the X-ray binary system Chi Per were made. During the observations, Chi Per was in a phase of rapidly increasing luminosity. The ultraviolet high resolution spectrum shows violet shifted broad absorption lines with the violet wings extending to -250/650 km/per sec. The double peaked H alpha line profile seems to be variable on time scale of days. An infrared excess probably due to an expanding envelope surrounding the OBe star, was observed. Author (ESA)

N81-13863# Consiglio Nazionale delle Ricerche, Milan (Italy). Lab. di Fisica Cosmica e Technologie Relative.
FAR ULTRAVIOLET OBSERVATIONS OF CYG X-2
L. Maraschi, E. G. Tanzi, and A. Treves *In* ESA 2nd European IUE Conf. Apr. 1980 p 169-171 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

Two far UV spectra of the optical counterpart of the binary X-ray source Cyg X-2 were taken. The results are compared with the expectations of a model where the X-rays are produced by an accreting neutron star and the optical and UV fluxes derive from the X-ray heated atmosphere of the primary. Author (ESA)

N81-13864# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
ULTRAVIOLET SPECTRAL VARIATIONS IN LMC X-4 AND SMC X-1
J. M. Bonnet-Bidaud, W. M. Glencross (University Coll., London), A. J. Willis (University Coll., London), G. Hammerschlag-Hensberge (Amsterdam Univ.), M. vanderKlis (Amsterdam Univ.), S. A. Ilovaisky (Observatoire de Paris-Meudon), and M. Mouchet (Observatoire de Paris-Meudon) *In* ESA 2nd European IUE Conf. Apr. 1980 p 173-175 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

Several low resolution International Ultraviolet Explorer IUE spectra of the massive X-ray binaries LMC X-4 and SMC X-1 were obtained at both short and long wavelengths. Highly ionized resonance lines of N(V), C(IV), and Si (IV) show marked changes with orbital phase, being particularly weak when the X-ray source is in front of the primary; the effect is most striking in LMC X-4. The continuum in each case shows the characteristic double wave light variation seen at visible wavelengths and with similar amplitude. Author (ESA)

N81-13865# Laboratorio di Astrofisica Spaziale, Frascati (Italy).
INTERNATIONAL ULTRAVIOLET EXPLORER (IUE) OBSERVATIONS OF THE GALACTIC GLOBULAR CLUSTER M80
V. Caloi, V. Castellani, A. Cassatella (ESA, Madrid), and D. Ponz (Inst. Nacional de Tecnica Aeroespacial, Madrid) *In* ESA 2nd European IUE Conf. Apr. 1980 p 179-182 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

International Ultraviolet Explorer observations of the globular cluster M80 are presented and discussed; their importance in relation to problems of galactic populations and population synthesis programs is stressed. A clear increase in flux toward short wavelengths was noticed, proving the presence of a large number of hot horizontal branch stars, the possibility of setting constraints on the color distribution of these stars, and the evolutionary history of the cluster itself. Author (ESA)

N81-13866# Observatoire de Paris-Meudon (France).
A VERY RAPIDLY EXPANDING GAS IN THE CORE OF THE X-RAY GLOBULAR CLUSTER NGC 6624
N. Bel, J. Clavel, and R. Foy *In* ESA 2nd European IUE Conf. Apr. 1980 p 183-184 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

International Ultraviolet Explorer observations of the center of the X-ray globular cluster NGC 6624 reveal an emission line spectrum. A tentative identification needs a very large velocity of 10,000 km/sec. A point source emits most of the UV flux with a continuum distribution. A resolved expanding nebula would emit the emission line spectrum. Author (ESA)

N81-13867# Groningen Rijksuniversiteit (Netherlands). Kapteyn Astronomical Inst.
C, N, AND O IN THE PLANETARY NEBULA NGC 2371
S. R. Pottasch, D. P. Gilra, A. Natta, A. Preite-Martinez, and P. R. Wesselius *In* ESA 2nd European IUE Conf. Apr. 1980 p 185-186 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

Low resolution IUE spectra were taken of NGC 2371, some centered on the central star, while other spectra include only the nebula. The resultant abundances are discussed.
Author (ESA)

N81-13868# European Space Agency, Madrid (Spain). Villafranca Satellite Tracking Station.

INTERNATIONAL ULTRAVIOLET EXPLORER (IUE) OBSERVATIONS OF PLANETARY NEBULAE: NEBULAR CONTINUUM AND MASS LOSS FROM CENTRAL STARS

P. Benvenuti and M. Perinotto (Osservatorio Astrofisico Arcreti) *In its* 2nd European IUE Conf. Apr. 1980 p 187-190 refs (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

International Ultraviolet Explorer low resolution spectra of eight planetary nebulae from low to fairly high excitation were taken. A nebular continuum was measured in NGC 7662 and shown to be essentially of atomic origin. A significant stellar wind from the nuclei of most of the planetaries was detected with velocities around 1000 - 3000 km/sec. A crude estimate of the associated mass loss is given. Author (ESA)

N81-13869# Heidelberg Univ. (West Germany). Inst. fuer Theoretische Astrophysik.

HIGH DISPERSION EUV OBSERVATIONS OF PLANETARY NEBULAE

J. Koeppen and R. Wehrse *In* ESA 2nd European IUE Conf. Apr. 1980 p 191-195 refs Sponsored in part by Deutsche Forschungsgemeinschaft (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

The three high excitation planetary nebulae NGC 3242, NGC 7009 and NGC 6210 were observed in the short wavelength range with high resolution. The most prominent emission lines are the He (II) 1640 and C (III) 1909 A lines. The C (IV) 1550 lines of NGC 3242 and NGC 7009 are in emission, whereas in NGC 6210 they are in absorption. This suggests that the central star of NGC 6210 is a subdwarf O. Author (ESA)

N81-13870# European Space Agency, Madrid (Spain). Astronomy Div.

A SEARCH FOR ABSORPTION IN THE FOURTH POSITIVE SYSTEM OF CO IN THE SPECTRUM OF THE PLANETARY NEBULAE IC 418

J. Clavel and D. Flower (Durham Univ., England) *In its* 2nd European IUE Conf. Apr. 1980 p 197-200 refs (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

The continuous emission of IC418 was observed at high dispersion and the spectrum searched for the A (1) pi - chi (1) Sigma (+) bands of CO. It was not possible to unequivocally detect these CO bands in IC418. However, an upper limit to the absorption by CO was determined, giving a column density which is much less than the value implied by the J = 1 approaching 0 rotational transition at 2.6 mm. Author (ESA)

N81-13871# Osservatorio Astrofisico di Arcetri, Florence (Italy).

ULTRAVIOLET EXTINCTION IN THE ORION NEBULA

P. Patriarchi and M. Perinotto *In* ESA 2nd European IUE Conf. Apr. 1980 p 201-203 refs (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

Extinction curves were obtained in the UV range in the direction of theta (1) Ori C in the central brightest area of the nebula and toward theta (2) Ori A which is located 2.3 arc minutes southeast from the Trapezium. The two extinction curves show significant differences amounting to about two magnitudes, the one toward theta (1) Ori C running below and the one toward theta (2) Ori A above the mean Orion curve found by others. Author (ESA)

N81-13872# Groningen Rijksuniversiteit (Netherlands). Kapteyn Astronomical Inst.

OBSERVATIONS OF H II REGIONS IN THE MAGELLANIC CLOUDS

D. P. Gilra, M. Dennefeld (European Southern Observatory, Geneva), and S. R. Pottasch *In* ESA 2nd European IUE Conf. Apr. 1980 p 205-206 refs (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

International Ultraviolet Explorer observations of 5 positions in the 30 Doradus region and one in N79A in the Large Magellanic Cloud, and, N81 and N66 in the Small Magellanic Cloud were obtained. The C (III) line at 1909 A was present in almost all the objects. Dust scattered light was detected in 30 Dor and N66. A preliminary analysis of the abundances in N81 shows that carbon is underabundant by about a factor of 10.

Author (ESA)

N81-13873# Landessternwarte auf dem Koenigstuhl, Heidelberg (West Germany).

UV SPECTROGRAMS OF T TAURI STARS

I. Appenzeller, C. Chavarria, J. Krautter, R. Mundt, and B. Wolf (Remeis-Sternwarte) *In* ESA 2nd European IUE Conf. Apr. 1980 p 209-211 (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

The IUE satellite was used to observe the ultraviolet spectra of the T Tauri stars DR Tauri, CoD - 35 deg 10525, and AS 205. In addition, earlier IUE spectrograms of the T Tauri star S CrA were reduced using a more effective procedure. The IUE observations were supplemented by simultaneous groundbased observations. All observed UV spectra show emission lines of a great variety of different atoms and ions. The ion of highest ionization stage observed is N (V). Two of the observed T Tauri stars show a strong UV continuum and UV envelope absorption lines. The occurrence of such absorption lines and a strong UV continuum seems to be related to the envelope density of these objects. The observed ultraviolet spectra of DR Tau, CoD -35 deg 10525, and AS 205 and of S CrA are shown. Author (ESA)

N81-13874# Remeis Sternwarte, Bamberg (West Germany).

MASS LOSS FROM THE INTERACTING CONTACT BINARY SV CEN

H. Dreschel, J. Rahe, and B. Wolf (Erlangen-Nurnberg Univ., West Germany) *In* ESA 2nd European IUE Conf. Apr. 1980 p 213-218 refs Sponsored by Deutsche Forchungsgemeinschaft (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

High resolution IUE spectrograms of the close eclipsing binary SV Cen (B1 (III) + B4) were taken near orbital phase 0.4 on 1979, November 3. The dominant spectral features are resonance lines of ionized metals (A1 (II), Mg (II), Si (IV), C (IV), etc.), and Fe (III) lines originating from metastable lower levels. The resonance line profiles are composed of a very broad stellar absorption feature of a total width of delta approximately 800 km sec and a strong absorption component shifted by approximately - 850 km/sec. The highly displaced resonance absorption lines prove the occurrence of mass loss. It is suggested that the angular momentum carried away by the ejected matter is responsible for the strong period decrease of SV Cen.

Author (ESA)

N81-13875# Osservatorio Astronomico, Trieste (Italy).

THE ULTRAVIOLET SPECTRA OF THE TWO COMPONENTS OF THE VISUAL BINARY SYSTEM DELTA 199

M. Hack, P. S. The (Amsterdam Univ.), and H. R. E. TjinADjie (Amsterdam Univ.) *In* ESA 2nd European IUE Conf. Apr. 1980 p 219-222 refs Sponsored by CNR-Serv. Appl. Spaziale (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

High resolution spectra of the two components of the visual binary system delta 199 were obtained with IUE. The HR 5999 is a nebular variable whose variability is mainly due to obscuration by circumstellar dust clouds and whose age is estimated at about 700,000 yr while the companion, HR 6000, is a DP star with strong phosphorus overabundance. This association establishes a lower limit for the age of chemically peculiar stars. Author (ESA)

N81-13876# Osservatorio Astronomico, Trieste (Italy).

INTERNATIONAL ULTRAVIOLET EXPLORER (IUE) OBSERVATIONS OF ZETA AURIGAE

R. Faraggiana and M. Hack *In* ESA 2nd European IUE Conf. Apr. 1980 p 223-226 refs Sponsored by CNR-Serv. Appl. Spaziale (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

High resolution IUE spectra of Zeta Aur were obtained near orbital phase 0.91, covering the 1175 to 3000 A region. The spectral type of the B companion is estimated as B7 V from its energy distribution, which gives T sub e = 12000 K, and the

strength of Si (III) lines. The absorption profiles of the strong lines are complex, indicating the presence of several components. High excitation features like the resonance lines of N (V), C (IV) and Si (IV) and lambda 1640 He (II) are present in absorption. These features are generally not present in late B main sequence stars. These observations suggest that the corona of the K star has extension at least double that derived from visual observations, with both low and high excitation features and a structure made of small condensations expanding outward. Author (ESA)

N81-13877# Groningen Rijksuniversiteit (Netherlands). Kapteyn Astronomical Inst.

OBSERVATIONS OF LATE-TYPE STARS WITH HOT COMPANIONS

D. P. Gilra, P. R. Wesselius, and N. Kameswararao (Indian Inst. of Astrophysics) *In* ESA 2nd European IUE Conf. Apr. 1980 p 227-228 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

International Ultraviolet Explorer and Astronomical Netherlands Satellite observations of the hot companions of omicron Ceti, epsilon Aur, and pi Pup are discussed. Observations of HD 62001, the central star of the nebula VV 1-7 are also reported. The nebula VV 1-7 which is present on the Palomar blueprint is not present on the ESO blueprints. Author (ESA)

N81-13878# Kiel Univ. (West Germany). Inst. fuer Theoretische Physik und Sternwarte.

OBSERVATIONAL EVIDENCE FOR AN ACCRETION DISK AROUND THE B STAR COMPANION OF DELTA SGE (M 2 II)

D. Reimers and R. P. Kudritzki *In* ESA 2nd European IUE Conf. Apr. 1980 p 229-232 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

High resolution International Ultraviolet Explorer spectra of delta Sge show broad, double peaked emission lines of Fe II, Cr II and ions superimposed upon a B star continuum. According to radial velocities, the broad emission lines are associated with the otherwise sharp-line late B main-sequence star. The lines are probably formed in a disk or gaseous ring which rotates 90 km/sec around the B star and which is formed by accretion from the stellar wind of the M supergiant. Inverse P Cygni-like profiles of lines of A1 (III), C (IV) and Si(IV) indicate infall of matter with velocities up to 300 km/sec near the B star. The disk luminosity obtained by summing up the UV emission lines is 10 to the 33rd power erg/sec, in rough agreement with the simple accretion theory of Bondi. Author (ESA)

N81-13879# European Space Agency, Madrid (Spain). Astronomy Div.

ULTRAVIOLET OBSERVATIONS OF MIRA CETI

A. Cassatella, J. Clavel, D. Gilra (Groningen Univ., Netherlands), D. Reimers (Kiel Univ.), and D. J. Stickland (UK Science Research Council, Madrid) *In its* 2nd European IUE Conf. Apr. 1980 p 233-236 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

International Ultraviolet Explorer observations of Mira Ceti show a wealth of emission lines, a continuum gradually increasing to long wavelengths and a number of absorption features due to Fe II, Mg II and perhaps Fe I and CO. These spectral components exhibit some variability and can be explained with a model of accretion into a disk around Mira B (a white dwarf) of material from Mira A (M6IIIe). Author (ESA)

N81-13880# Vrije Universiteit, Brussels (Belgium). Inst. of Astrophysics.

SIMULTANEOUS OBSERVATIONS OF V861 SCO

C. deLoore, M. Burger, I. D. Howarth (University Coll., London), R. Wilson (University Coll., London), B. S. Carter, J. W. Menzies (South African Astronomical Observatory), G. Roberts (South African Astronomical Observatory), P. A. Whitelock (South African Astronomical Observatory), E. L. vanDessel (Royal Belgium Observatory), and M. C. W. Sandford (Science Research Council, Slough, England) *In* ESA 2nd European IUE Conf. Apr. 1980 p 237-242 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

High dispersion spectra of V861 Sco (HD 152667) taken with International Ultraviolet Explorer at several orbital phases are presented, as well as simultaneous optical spectroscopy, and UVBY and infrared photometry. The UV spectrum is normal for a BOIa supergiant; a number of lines show P Cygni profiles with, in several cases, sharp multiple absorption components. No large phase dependent variations in the UV are detectable. The optical spectra reveal significant changes at H, He I 6678 and especially at H which is seen in emission and in absorption at different times. The velocity variability is strongly correlated with the outward velocity in the sense that velocities further out in the wind show more variability. The infrared photometry does not support the idea of a compact secondary. An evolutionary scenario, starting from a ZAMS-system of 80 solar masses + 10 solar masses is developed leading to an actual system of a 34 solar masses (BOI a) primary with a 10 solar mass (B2V) companion. The primary which just ignited helium in the core is nearly filling its Roche lobe, and will start soon (or has just started) a case B of mass transfer. The mass loss rate is estimated from the UV at 1.5 x 10 to the minus 6th power solar masses/year, and from theoretical considerations of the system parameters at 2.5 x 10 to the minus 6th power solar masses/year infrared excess points to 0.00005 solar masses/year. Author (ESA)

N81-13881# European Space Agency, Madrid (Spain). Astronomy Div.

CHANGES IN INTERNATIONAL ULTRAVIOLET EXPLORER (IUE) POSTMAXIMUM SPECTRA OF THE MIRA VARIABLE CHI CYGNI

A. Cassatella, A. Heck, F. Querci (Observatoire de Paris-Meudon) M. Querci (Observatoire de Paris-Meudon), and D. J. Stickland (UK Science Research Council, Madrid) *In its* 2nd European IUE Conf. Apr. 1980 p 243-245 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

International Ultraviolet Explorer long-wavelength (2500 - 3350 A) spectra of the long-period variable chi Cygni were obtained at phases phi = 0.04, 0.18, and 0.22 following the 1979 light maximum. Low spectral resolution was used except for the last phase studied where a high resolution spectrum was secured. At phase 0.04, the Fe II (V1) emission lines are outstanding features together with absorption lines as the Fe I (V9) lines. The Mg II h and k emission doublet is absent: instead an absorption feature appeared suggesting re-absorption by an outer layer. Two months later, at phi = 0.18, other emission lines appeared in the low resolution spectrum as the Mg II doublet and the Fe II (UVI) lines. Their high resolution asymmetric profiles (at phase 0.22) are discussed. These observations are interpreted on the basis of a shock wave model. Author (ESA)

N81-13882# Eidgenoessische Technische Hochschule, Zurich (Switzerland). Atomic Physics and Astrophysics Group.

ULTRAVIOLET ENERGY DISTRIBUTION OF WOLF-RAYET STARS

W. Schmutz and L. J. Smith (University Coll., London) *In* ESA 2nd European IUE Conf. Apr. 1980 p 249-251 refs Sponsored in cooperation with UK Science Research Council and Swiss Science Foundation (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

Low resolution spectra of 15 Wolf-Rayet stars (10 WN and 5 WC stars) were analyzed to investigate their UV continuum distribution. The reddening observed for Wolf-Rayet stars is found to follow the general galactic interstellar extinction law. Color excesses for each star are deduced from the observed strength of the 2200A feature. The combined de-reddened UV-visible continua are compared with black body energy distributions to deduce color temperatures. Four stars are analyzed on the basis of Cassinelli and Hartmann's theory for extended emitting regions. Author (ESA)

N81-13883# Laboratoire d'Astronomie Spatiale, Marseille (France).

THE UV SURFACE BRIGHTNESS DISTRIBUTION IN THE CENTRAL REGION OF THE GALAXY M31

J. M. Deharveng, G. Monnet (Observatoire de Lyon), and M. Maucherat-Joubert *In* ESA 2nd European IUE Conf. Apr. 1980 p 253-255 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

International Ultraviolet Explorer observations were used to investigate the UV surface brightness distribution in the central region of M31 to determine the origin of the excess UV light found there. From a comparison with previous UV photometric measurements it is found that the UV distribution is similar to the B light distribution. A possible steeper gradient in the inner bulge is also discussed. Hot stars in old stellar population are thus suggested as the major source of the excess UV light.
Author (ESA)

N81-13884# Science Research Council, Chilton (England). Astrophysics Group.
OBSERVATIONS OF THE STAR-LIKE BL LAC OBJECT OI 090-4
G. E. Bromage, W. M. Burton, B. E. Patchett, and A. G. Smith (Florida Univ., Gainesville) *In* ESA 2nd European IUE Conf. Apr. 1980 p 267-269 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

Results of simultaneous International Ultraviolet Explorer (IUE) spectroscopy and UBVI photometry are presented for an apparently star-like BL Lac object, the Ohio radio source OI 090.4. The spectrum is featureless and the continuum is well fitted by a power law F sub nu varies as nu to the minus 2nd power in the range 14.7 less than log nu less that 15.4. The absence of interstellar '2200' yields E sub B-V equal to or less than 0.03 mag., much lower than average for the object's galactic latitude. The flux distribution is compared with that for two nearby at the objects in elliptical galaxies, Mkn 421 and Mkn 501, as observed both in early 1978 and in March 1979. Comments are made concerning IUE analysis procedures for faint spectra on high-background images. Author (ESA)

N81-13885# Universitaets-Sternwarte Goettingen (West Germany).
INTERNATIONAL ULTRAVIOLET EXPLORER (IUE) OBSERVATIONS OF SEYFERT GALAXIES AND A BL LAC OBJECT
H. Schleicher, K. J. Fricke, and W. Kollatschny *In* ESA 2nd European IUE Conf. Apr. 1980 p 271-278 refs (For primary document see N81-13817 04-89)
(Contract DFG-FR-325/8)
Avail: NTIS HC A19/MF A01

Spectrophotometric data for Seyfert galaxies NGC 1566, NGC7603, Akn 120, and Mkn 3, and the BL Lac object 0716 + 71 were taken. Spectra in short and long wavelength regions corrected for galactic reddening are presented as well as absolute emission line intensities. Author (ESA)

N81-13886# University Coll., London (England). Dept. of Physics and Astronomy.
INTERNATIONAL ULTRAVIOLET EXPLORER (IUE) OBSERVATIONS OF THE SEYFERT 1 GALAXIES I ZW 1, II ZW 136, AND MK 231
M. A. J. Snijders, A. Boksenberg, J. D. J. Haskell, R. A. E. Fosbury (Royal Greenwich Observatory), and M. V. Penston (ESA, Madrid) *In* ESA 2nd European IUE Conf. Apr. 1980 p 279-287 refs Sponsored in part by UK Science Research Council (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

Repeated observations of the Seyfert 1 galaxies I Zw 1, II Zw 136 and Mk 231, which all have very strong Fe II emission lines in the optical region, were made at low resolution with the International Ultraviolet Explorer satellite. The ultraviolet spectra of I Zw 1 and II 2w 136 are very similar: both are variable and show broad emmission features of Fe II (especially the UV multiplets 1, 33, 60, 62 and 63) as well as the emission lines usually strong in Seyferts and quasars e.g., Lyman alpha, Mg II, C III, C IV and N V. Nk 231 has a completely different ultraviolet spectrum : there is no evidence for variability and only low ionization lines of Mg II, Fe II and Lyman alpha are present both in emission and absorption; the strongest absorption lines all belong to the Z = 0.043 system, which is probably of stellar origin. The data strongly support the hypothesis that the optical Fe II emission lines are primarily due to collisional excitation and that resonance fluorescence makes only a minor contribution to the excitation of these lines. Author (ESA)

N81-13887# University Coll., London (England). Dept. of Physics and Astronomy.
INTERNATIONAL ULTRAVIOLET EXPLORER (IUE) OBSERVATIONS OF X-RAY EMITTING SEYFERT GALAXIES
P. Barr, A. J. Willis, and R. Wilson *In* ESA 2nd European IUE Conf. Apr. 1980 p 289-292 refs Sponsored by UK Science Research Council (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

International Ultraviolet Explorer observations were made of the X-ray emitting Seyfert galaxies NGC 3783, Mkn 506, Mkn 279, 3C 390.3 and NGC 5548. The continuum intensities lead to estimates of reddening consistent with local (galactic) extinction; there is no evidence for any reddening intrinsic to the source. The (rest-frame) ratios log F lambda (1450 A) vs log W lambda (C IV) deduced from this sample indicate when combined with similar observations of high-z Seyferts, a correlation similar to that observed in OSOs. Repeated observations of NGC 3783 revealed continuum variability by a factor 3 in seven months, the spectrum becoming harder as the flux density increases. The low degree of extinction observed in this source in November 1978 contrasts strongly with the high degree of X-ray absorption detected by the Ariol V satellite three weeks earlier. Author (ESA)

N81-13888# Science Research Council, Slough (England). Rutherford and Appleton Lab.
INTERNATIONAL ULTRAVIOLET EXPLORER (IUE) OBSERVATIONS OF THE TWIN QSO'S 0957 + 561 A, B
P. M. Gondhalekar and R. Wilson (University Coll., London) *In* ESA 2nd European IUE Conf. Apr. 1980 p 295-298 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

The ultraviolet spectra of the twin quasars 0957 + 561 A,B were obtained with International Ultraviolet Explorer. These quasars are suspected to be the images of a single object formed by an intervening galaxy acting as a gravitational lens. The ultraviolet data give an intensity ratio for the two objects which is the same, within the errors, as that derived at radio frequencies. This shows that differential reddening between the two light paths is negligible and also given support to the gravitational lens hypothesis. Author (ESA)

N81-13889# Consiglio Nazionale delle Ricerche, Milan (Italy). Lab. di Fisica Cosmica e Technologie Relative.
FAR ULTRAVIOLET OBSERVATIONS OF THE QUASAR PG1351+64
L. Maraschi, E. G. Tanzi, and A. Treves (Milan Univ.) *In* ESA 2nd European IUE Conf. Apr. 1980 p 299-301 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

Short and long wavelength spectra of the low red-shift QSO PG1351+64, obtained with International Ultraviolet Explorer, are presented. The continuum can be fitted by a power law F lambda varies as lambda to the 0.2 power, with a luminosity of 9 x 10 to the 44th power ergs/sec between 1200 and 3200 A. The eq.w. of lyman alpha is 100 A with a FWHM of 12 A. Strong local absorption is observed in the C IV line (+1780 km/sec). The results are discussed with respect to the suggested correlations between quasar properties. Author (ESA)

N81-13890# Kiel Univ. (West Germany). Inst. fuer Theoretische Physik und Sternwarte.
THE NITROGEN AND SILICON ABUNDANCE OF SdO-STARS
K. P. Simon, J. Gruschinske, K. Hunger, and R. P. Kudritzki *In* ESA 2nd European IUE Conf. Apr. 1980 p 305-306 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

Abundances of nitrogen and silicon were determined by means of multi-level calculations for three helium-rich subluminous O-stars, HD 49798, HD 127493 and BD+75 deg 325. Analysis of the line spectra of a III and Si IV yields three results: microturbulence is small, i.e., less than 10 km sec; the silicon abundance is solar, and nitrogen is strongly overabundant. Taking into account the carbon-deficiency of these stars and the fact that no lines of oxygen are seen in the spectra, it is concluded that CNO cycle-processed material is involved. Author (ESA)

N81-13891# Kiel Univ. (West Germany). Inst. fuer Theoretische Physik und Sternwarte.

NON-LTE ANALYSIS OF THE SdO STAR BD+75 DEG 325

R-P. Kudritzki, K. Hunger, J. Gruschinske, K. P. Simon, and J. P. Kaufmann (Technische Univ., Berlin) *In* ESA 2nd European IUE Conf. Apr. 1980 p 307-310 refs (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

Effective temperature, gravity and helium abundance were determined by a NLTE analysis of high resolution International Ultraviolet Explorer spectra and visual coude spectra. The results are: T sub eff = 55,000 K + or - 2500 K, log g = 5.3 + or - 0.3 (CGS), N (HE)/(N (H) + N (HE)) = 0.6 - 0.10 + 0.15. The evolutionary status of BD + 75 deg 325, as well as of other SdO stars, is discussed by comparing the positions in the T sub eff plane with evolutionary tracks computed for stars with similar H-He mixtures. Author (ESA)

N81-13892# Kiel Univ. (West Germany). Inst. fuer Theoretische Physik und Sternwarte.

THE CARBON ABUNDANCE OF SdO-STARS

J. Gruschinske, K. Hunger, R. P. Kudritzki, and K. P. Simon *In* ESA 2nd European IUE Conf. Apr. 1980 p 311-314 refs (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

High resolution International Ultraviolet Explorer spectra of the three SdO-stars HD 127493, HD 49798 and BD + 75 deg 325 were used to derive an upper limit for the carbon abundance. The C IV resonance line doublet at lambda 1548/1551 was analyzed by means of non-LTE line formation in the two level approximation. All three SdO-stars were found to be carbon-deficient by at least a factor of ten (relative to the Sun). Author (ESA)

N81-13893# Heidelberg Univ. (West Germany). Inst. fuer Theoretische Astrophysik.

THE FAR ULTRAVIOLET SPECTRUM OF THE OB-TYPE SUBDWARF HD 149 382

B. Baschek, R-P. Kudritzki (Kiel Univ.), and M. Scholz *In* ESA 2nd European IUE Conf. Apr. 1980 p 315-318 refs Sponsored in part by Deutsche Forschungsgemeinschaft (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

High resolution International Ultraviolet Explorer spectra of the OB-type subdwarf HD 149 382 were obtained from lambda = 1160 to 3230 A. The stellar spectrum, which only shows hydrogen, helium and sulfur lines in the blue, exhibits more than 1500 absorption features with central depths greater than 0.2 in the far ultraviolet. He II 1640 is the only helium line found in this spectral region. The spectrum is dominated by the doubly and triply ionized stages of carbon, nitrogen and twelve heavier elements which are certainly or probably present. Oxygen and eleven other elements are possibly present. The Si IV resonance doublet at 1394 and 1403 A was not found. Preliminary atmospheric parameters t sub eff = 35000 K, g = 10 to the 5.5 power cm s to the -2 power, log N sub He/N sub H = -1.4 were derived. Author (ESA)

N81-13894# Heidelberg Univ. (West Germany). Inst. fuer Theoretische Astrophysik.

THE FAR ULTRAVIOLET SPECTRUM OF THE B-TYPE SUBDWARF HD 205 805

B. Baschek, R-P. Kudritzki (Kiel Univ.), and M. Scholz *In* ESA 2nd European IUE Conf. Apr. 1980 p 319-322 refs Sponsored in part by Deutsche Forchungsgemeinschaft (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

High resolution International Ultraviolet Explorer spectra of HD 205 805 (sdB, m sub v = 10.2, T sub eff = 26500 K, g = 100.00 cm s to the minus 2d power) were obtained in the range 1170-3230 A. Some 1150 absorption lines with central depths equal to or greater than 0.2 were measured. A radial velocity of -80 km sec permitted a distinction to be made between stellar and interstellar lines. The stellar spectrum exhibits many lines of doubly ionized elements, especially of C, Si, S, Ti, Cr, Mn and Fe. Preliminary estimates of selected abundances are given by comparison with the normal B star gamma Peg. Author (ESA)

N81-13895# Laboratorio di Astrofisica Spaziale, Frascati (Italy).

ANALYSIS OF THE UV SPECTRUM OF THREE HOT SUBDWARFS

L. Rossi, R. Viotti, J. Darius (ESA, Madrid), and F. D'Antona (Osservatorio Astronomico, Rome) *In* ESA 2nd European IUE Conf. Apr. 1980 p 323-325 refs (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

International Ultraviolet Explorer high resolution observations of three O subdwarfs (BD + 37 deg 442, BD + 32 deg 1977, and BD + 48 deg 1777) were taken. The spectra are characterized by very high excitation photospheric lines. Intense interstellar lines are present, whose possible circumstellar origin is suggested in view of the absence of the 2200 A interstellar band. Author (ESA)

N81-13896# Kiel Univ. (West Germany). Inst. fuer Theoretische Physik und Sternwarte.

UV OBSERVATIONS OF TWO EXTREMELY HELIUM RICH STARS

U. Heber and D. Schnoeberner *In* ESA 2nd European IUE Conf. Apr. 1980 p 327-332 refs (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

Ultraviolet spectrograms of BD + 10 deg 2179 and BD - 9 deg 4395 were obtained with the International Ultraviolet Explorer in the low resolution mode. No evidence for mass loss was found. The observations were analyzed by comparison with detailed LTE-model fluxes including 800 atomic transitions. The results confirm earlier analyses of visual spectra. Author (ESA)

N81-13897# Kiel Univ. (West Germany). Inst. fuer Theoretische Physik und Sternwarte.

A STRONG ABSORPTION FEATURE NEAR 1900 A IN THE SPECTRUM OF THE C2 WHITE DWARF LP 145 141

D. Koester *In* ESA 2nd European IUE Conf. Apr. 1980 p 333-337 refs (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

An absorption feature of exceptional strength was detected in the spectrum of the cool degenerate lambda 4670 or C2 star LP 145-141. This feature is tentatively identified as a dissociation continuum of C2. Theoretical calculations of dissociation and ionization equilibria confirm that molecule formation is strongly favored in the helium-rich, high pressure atmosphere of this object, with CO, C2, or O2 being dominant, depending on the He/C and C/O ratios. Author (ESA)

N81-13898# European Space Agency, Madrid (Spain). Astronomy Div.

INTERNATIONAL ULTRAVIOLET EXPLORER (IUE) OBSERVATIONS OF THE CRAB PULSAR

P. Benvenuti, L. Bianchi, A. Cassatella, J. Clavel, J. Darius, A. Heck, M. V. Penston, F. Macchetto, P. L. Selvelli (Osservatorio Astronomie, Trieste), and J. Zamorano *In its* 2nd European IUE Conf. Apr. 1980 p 339-342 refs (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

The UV spectrum of the Crab Nebula Pulsar was detected with the International Ultraviolet Explorer long wavelength spectrograph. The data are in good agreement with the optical spectrum. The interstellar extinction seems to deviate from the standard law in the 2200 A region. Author (ESA)

N81-13899# Science Research Council, Chilton (England). Astrophysics Group.

THE DISTRIBUTION OF INTERSTELLAR C IV IN THE GALAXY

G. E. Bromage, A. H. Gabriel, and D. W. Sciama (Oxford Univ.) *In* ESA 2nd European IUE Conf. Apr. 1980 p 345-351 refs (For primary document see N81-13817 04-89)

Avail: NTIS HC A19/MF A01

Some high dispersion spectra of 13 halo and disc stars were reduced and column densities of C IV presented. The galactic distribution of C IV is discussed and, combining the data with other published measurements, a mean exponential scale height of 3 + 2 -1 kpc and disk space density n sub o = 8.5 x 10 to the minus 9th power cu cm are derived. The results were compared with Copernicus O VI data. Strengths and profiles of

Si IV, C IV and N V from International Ultraviolet Explorer data were also compared for a few representative lines of sight. N V/O VI ratios imply log T 5.5, while SI IV/C IV (including the value for the whole halo towards 3C 273) require 4.80 less than Log T less than 4.95. Author (ESA)

N81-13900# Science Research Council, Chilton (England). Astrophysics Group.
THE ULTRAVIOLET SPECTRUM OF THE ANOMALOUS EUV-SOURCE HALO STAR HD 192273
G. E. Bromage, A. H. Gabriel, and D. W. Sciama (Oxford Univ.) *In* ESA 2nd European IUE Conf. Apr. 1980 p 353-356 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

The proposed EUV source HD 192273 was observed with International Ultraviolet Explorer at both low and high resolution. Results of an analysis of the stellar and interstellar spectrum are presented. Strengths of interstellar absorption lines give a value for the column density of neutral hydrogen atoms, N sub H = 2.0 + or - 0.5 x 10 to the 20th power cm sq, making the proposed EUV identification untenable. The star appears to be a normal B2 V star with e sub B-V = 0.04 but an approximate distance of 0.5 kpc was derived from the IUE data and this leaves the star 4 magnitudes too faint for Be V.
Author (ESA)

N81-13901# Tuebingen Univ. (West Germany). Astronomisches Inst.
INTERNATIONAL ULTRAVIOLET EXPLORER (IUE) OBSERVATIONS OF HD 269546
M. Grewing and E. Schulz-Luepertz *In* ESA 2nd European IUE Conf. Apr. 1980 p 357-359 refs (For primary document see N81-13817 04-89)
Avail: NTIS HC A19/MF A01

High and low resolution spectra of the Large Magellanic Cloud (LMC) star HD 269546 were obtained. This star has often been classified as B31p or B41 + WN. The shape of the observed UV spectral energy distribution is discussed in light of this classification. The spectrum is seen to rise towards shorter wavelengths, confirming other results. It is devoid of strong emission features except for He II lambda 1640 and geocoronal H I lambda 1216. Absorption occurs over a wide range of velocities for most of the species shown. Two main components of absorption exist at roughly 0 km/sec and 270 km/sec. The first of these arises in our own galaxy, while the latter is due to Large Magellanic Cloud gas. Si III and S III seem to absorb over the entire velocity range from 0 km/sec to 300 km/sec without an obvious component structure being visible.
Author (ESA)

N81-13902 Florida Univ., Gainesville.
NEAR INFRARED AND RADIO OBSERVATIONS OF SELECTED CLOSE BINARY STARS Ph.D. Thesis
David Robert Florkowski 1980 175 p
Avail: Univ. Microfilms Order No. 8029059

Photoelectric observations were made of two eclipsing stars, AS Velorum and TW Cassiopeiae. The light curves were analyzed. While several solutions would fit an individual light curve, no solution could be found to satisfy all the data. The Wolf-Rayer binary star HD 193793 was detected at centimeter wavelengths with the interferometer. Subsequent observations were made with this instrument and with the completed portion of the Very Large Array. Variations in the flux density of HD 193793 were observed. The radio data together with published infrared observations were used to describe the ejection of material via a stellar wind from this binary system. Dissert. Abstr.

N81-13211*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RADIO ASTRONOMY
R. M. Taylor and R. N. Manchester (CSIRO, Sydney) *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 1-5 (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 03A

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N81-13903 Iowa Univ., Iowa City.
ALUMINUM HYDRIDE FORMATION IN THE RELAXATION ZONES FOLLOWING SHOCK WAVES IN THE ATMOSPHERES OF LONG PERIOD-VARIABLE STARS Ph.D. Thesis
James Newsome Pierce 1980 86 p
Avail: Univ. Microfilms Order No. 8028631

The phase variations of aluminum hydride emission lines in long period variable spectra were investigated using a model of the post shock relaxation zone. Conditions at the shock were linked to position in the atmosphere and phase by a global, isothermal shock model. The model was applied at densities where the shocks were estimated to be optically thin, and molecular species were assumed to play a negligible role in determining the thermodynamic state of the gas. The temperature of the atmosphere increases with radius. The observed variations in AlH emission with phase are not caused solely by variations in the AlE formation rate, which decrease rapidly with decreasing density. Instead, the emergence and increased prominence of the emission lines toward minimum light are caused by the increasing transparency of the rising shock. Following minimum light, the declining formation rate diminishes the AlH emission lines, preventing their detection in the upper shock; this is consistent with the absence of the lines around maximum light.
Dissert. Abstr.

N81-13904 Yale Univ., New Haven, Conn.
ON THE HYDRODYNAMIC STABILITY AND WAVE INTERACTIONS OF IONIZATION-SHOCK FRONTS Ph.D. Thesis
John Lawrence Giuliani 1980 178 p
Avail: Univ. Microfilms Order No. 8026973

The hydrodynamic stability was investigated under the assumption of small amplitude perturbations allowing linearization of the equations. The evolving, unperturbed gate is described by a similarity solution for simplicity. A technique was developed which reduces the stability problem from a system of partial differential equations and associated boundary conditions to a coupled set of ordinary differential equations with time dependent coefficients. This approach is shown to be valid as long as the transverse perturbation wavelength is much greater than the thickness of the ionization shock front. A semianalytic method to solve for the flow configuration resulting from a one dimensional interaction between an ionization front and a shock, rarefaction wave or contact discontinuity was developed. This approach complements the linear stability analysis of finite wavelength perturbations since it can deal with strong disturbances, but it sacrifices the two dimensionality of the previous study. Dissert. Abstr.

N81-13905 Yale Univ., New Haven, Conn.
THE EFFECT OF DIFFERENTIAL ROTATION ON THE INTERNAL STRUCTURE OF LOW MASS STARS Ph.D. Thesis
Wai-Yuen Law 1980 164 p
Avail: Univ. Microfilms Order No. 8026420

Axisymmetric, differentially rotating main sequence models for stars for 0.9M and homogeneous composition were constructed. Differential rotation produces significant effects on the interior of the models. The most noteworthy feature is the decrease in luminosity due to rotation. Stellar mass luminosity relation is substantially affected by differential rotation. Differential rotation also causes a large decrease in central pressure, temperature and density. The main sequence lifetimes of the rotating models, estimated from the stellar mass and luminosity, can be increased by more than a factor of 3 over the lifetimes of nonrotating stars of the same mass, and as much as 30 percent over the lifetimes of lower mass, nonrotating stars with comparable luminosities. Dissert. Abstr.

N81-13906*# University of Southern California, Los Angeles. Dept. of Astronomy.
COPERNICUS OBSERVATIONS OF C I AND CO IN DIFFUSE

INTERSTELLAR CLOUDS Final Technical Report, 14 Mar. 1977 - 13 Nov. 1980
E. Jenkins (Princeton Univ.), M. Jura, and M. Loewenstein 13 Nov. 1980 57 p refs
(Grant NsG-5169)
(NASA-CR-163789) Avail: NTIS HC A04/MF A01 CSCL 03B

Copernicus was used to observe absorption lines of C I in its ground state and excited fine structure levels and CO toward 29 stars. We use the C I data to infer densities and pressures within the observed clouds, and because our results are of higher precision than previous work, much more precise estimates of the physical conditions in clouds are obtained. In agreement with previous work, the interstellar thermal pressure appears to be variable, with most clouds having values of p/k between 1000/cu cm K and 10,000/cu cm K, but there are some clouds with p/k as high as 100,000/cu cm K. Our results are consistent with the view that the interstellar thermal pressure is so variable that the gas undergoes continuous dynamic evolution. Our observations provide useful constraints on the physical processes on the surfaces of grains. In particular, we find that grains are efficient catalysts of interstellar H2 in the sense that at least half of the hydrogen atoms that strike grains come off as part of H2. Results place strong constraints on models for the formation and destruction of interstellar CO. In many clouds, an order of magnitude less CO than predicted in some models was found. Author

N81-13907 Princeton Univ., N. J.
DYNAMICS AND STABILITY OF TROJAN LIBRATIONS IN THE EARTH-SUN SYSTEM, IMPLICATIONS FOR THE EXISTENCE OF AN EARTH TROJAN ASTEROID GROUP Ph.D. Thesis
Roy Scott Dunbar 1980 129 p
Avail: Univ. Microfilms Order No. 8027700

The plausibility of the Earth possessing Trojan type asteroids, librating about the LA and 1.5 points of the Earth-Sun system is investigated. A study of the motion of these bodies in the three body system of planet-Sun-asteroid, and then of the perturbation of the motion by other major planets are described. Instabilities of Trojan orbits can occur due to resonances of long period frequencies of the motion with long period perturbation frequencies. A secular resonance between the perihelion precession frequency of large amplitude librations and a forced secular oscillation frequency of the solar system exists. The mass of the principal planet plays a role in limiting the extent of the stable region in which real asteroids may exist. The origin and evolution of Trojan asteroids are affected by their location in the solar system. Because of their proximity to the Sun, Earth Trojans can be expected to be composed primarily of silicates and metal, and depleted in lighter elements. Trojan orbits exist in the Earth-Sun system which may be stable for very long times. Dissert. Abstr.

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N81-13908# Stanford Univ., Calif. Dept. of Computer Science.
MODELLING THE ENVIRONMENT OF AN EXPLORING VEHICLE BY MEANS OF STEREO VISION Ph.D. Thesis
Donald Bernard Gennery Jun. 1980 164 p refs
(Contract MDA903-80-C-0102)
(AD-A091081; SU-STAN-CS-80-805; SU-AIM-339) Copyright. Avail: Issuing Activity CSCL 14/5

This dissertation describes research involving vision techniques which would be useful in an autonomous exploring vehicle, such as a Mars rover. These techniques produce a description of the surroundings of the vehicle in terms of the position, size, and approximate shape of objects, and can match such scene descriptions with others previously produced. The information produced is thus useful both for navigation and obstacle avoidance. The techniques operate by using three dimensional data which they can produce by means of stereo vision from stereo picture pairs or which can be obtained from a laser rangefinder. The research thus divides conveniently into two portions: stereo mapping and three dimensional modelling and matching. The stereo mapping techniques are designed to be suitable for the kind of pictures that a Mars rover might obtain and to produce the kind of data that the modelling techniques need. These stereo techniques are based upon area correlation and produce a depth map of the scene. Emphasis is placed upon extraction of useful data from noisy pictures and upon the estimation of the accuracy of the data produced. Included are the following: a self-calibration method for computing the stero camera model (the relative position and orientation of the two camera positions); a high-resolution stereo correlator for producing accurate matches with accuracy and confidence estimates, which includes the ability to compensate for brightness and contrast changes between the pictures; a search technique for using the correlator to produce a dense sampling of matched points for a pair of pictures; and the computation of the distances to the matched points, including the propagation of the accuracy estimates. GRA

N81-13909 Pittsburgh Univ., Pa.
REFLECTION SPECTROSCOPY OF STONY METEORITES IN THE VACUUM ULTRAVIOLET SPECTRAL REGION Ph.D. Thesis
Jeffrey Karl Wagner 1980 232 p
Avail: Univ. Microfilms Order No. 8028060

Reflectance spectra of polished thin sections and powders of samples of all groups of stony meteorites, as well as numerous mineral standards, were measured from 5 to 14 eV photon energy (248 to 89 nm wavelength). Observed effective valence-conduction bandgap (Eg) peak locations were compared with those predicted by the experimental relationships for those minerals, and agree well in most cases. The spectra of carbonaceous chondrites contain olivine and orthopyroxene peaks, as well as peaks from other minerals such as spinel and phyllosilicates. Spectra of ordinary chondrites contain peaks from olivine, pyroxenes, and feldspar. Petrologic type is not distinguishable since change in type does not involve change in chemical composition. Spectra of enstatite chondrites and a chondrites exhibit only peaks due to nearly iron free enstatite, as well as accesory plagioclase. Spectra of the remaining achondrites, each of which consists of one or two major minerals, contain peaks of these minerals. While VUV spectroscopy is unable to assign a meteorite to a given chemical and petrologic classification, a limited classification of a meteorite may be made. Dissert. Abstr.

N81-13910 Arizona State Univ., Tempe.
THE CHEMISTRY, STRUCTURE AND MINERALOGY OF LIGHT-DARK ORDINARY CHRONDRITES Ph.D. Thesis
Lynn Edward Lalko 1980 144 p
Avail: Univ. Microfilms Order No. 8027647

The light and dark portions and inclusions from 14 brecciated ordinary chondrites are characterized. In all, 42 samples were analyzed by atomic absorption spectroscopy for the elements: Al, Ca, Fe, Mg, Si, Na, and K. In all but one case the dark portions have Mg/Si, Ca/Si, and Al/Si ratios that were similar to the ordinary chondritic, light colored host portions. This implies that these light dark structured meteorites are mixtures from the same or closely related parent bodies. One such chondrite, Plainview, was thoroughly studied. Plainview is a shocked and brecciated meteorite which formed on the regolith of a parent body of at 135 km in radius. The silicates in the light and dark portions are identical in composition and homogeneous. But each portion has a different metallographic cooling rate. The fine grained dark portion contains fragments of widely differing appearance. But only 2 inclusions, which are carbonaceous chondrite material, represent definite cases of foreign material. The remainder of the dark colored portion represents Plainview or closely related light material which was pulverized and darkened by strong shock events. Dissert. Abstr.

N81-13214*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

VOYAGER MISSION SUPPORT (2)
N. Fanelli and H. E. Nance *In its* The Telecommun. and Data Acquisition 15 Dec. 1980 p 44-59 refs (For primary document see N81-13210 04-31)
Avail: NTIS HC A09/MF A01 CSCL 03B

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N81-13911 Yale Univ., New Haven, Conn.
AN OBSERVATIONAL STUDY OF THE CHEMICAL EVOLUTION OF THE SOLAR NEIGHBORHOOD Ph.D. Thesis
Bruce Anthony Twarog 1980 178 p
Avail: Univ. Microfilms Order No. 8026436

The possible ways of measuring the age metallicity relation (AMR) for the disk of the Galaxy in the neighborhood of the Sun are discussed. It is shown that the use of a field star sample chosen on the basis of effective temperature, the most commonly used technique, introduces a bias which results in a monotonic increase in the metal abundance of the disk with time. However, if the AMR for the disk can be shown to satisfy certain criteria, the bias introduced by such a sample can be neglected; the Galactic disk apparently satisfies the criteria. It is concluded that a sample selected and analyzed through the use of UVBY and H beta photometry, in conjunction with a self consistent set of theoretical isochrones, provides the least biased, most accurate estimate of the AMR for the disk. New data for 1007 stars chosen to avoid selection effects and observed in the UVBY and H beta systems are presented. Dissert. Abstr.

N81-13912*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ENVIRONMENTAL ANALYSIS OF THE CHEMICAL RELEASE MODULE
James P. Heppner and Maurice Dubin Nov. 1980 131 p refs
(NASA-TP-1750; Rept-80-F-5120) Avail: NTIS HC A07/MF A01 CSCL 13B

The environmental analysis of the Chemical Release Module (a free flying spacecraft deployed from the space shuttle to perform chemical release experiments) is reviewed. Considerations of possible effects of the injectants on human health, ionosphere, weather, ground based optical astronomical observations, and satellite operations are included. It is concluded that no deleterious environmental effects of widespread or long lasting nature are anticipated from chemical releases in the upper atmosphere of the type indicated for the program. M.G.

N81-13913# Los Alamos Scientific Lab., N. Mex. Theoretical Div.
NUMERICAL SIMULATION OF THE SOLAR GRANULATION
Lawrence D. Cloutman Aug. 1980 7 p refs Presented at the Intern. Astron. Union Colloq. 58 on Stellar Hydrodyn., Los Alamos, N. Mex., 12-15 Aug. 1980
(Contract W-7405-eng-36)
(LA-UR-80-2732; CONF-800872-2) Avail: NTIS HC A02/MF A01

The solar granulation is simulated by numerical solution of the multidimensional, time dependent, nonlinear Navier-Stokes equations applied to the solar atmosphere. Granules may be explained as buoyantly rising bubbles created at the level where T = 8000 K, and which have collapsed into vortex rings. The calculation is in quantitative agreement with observations and has a number of implications for solar physics and convection theory. DOE

93 SPACE RADIATION

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99 GENERAL

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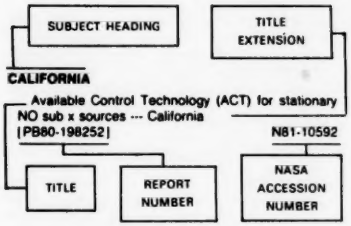

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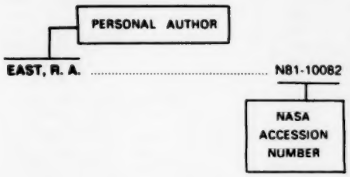

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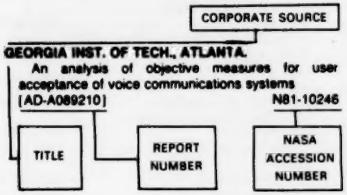

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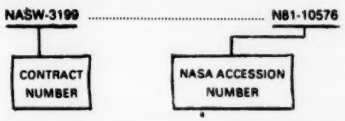

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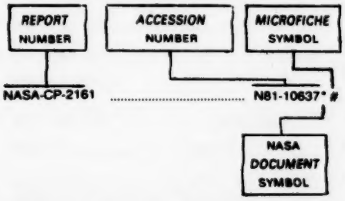

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